UNIVERSITY OF CALIFORNIA

PUBLISHED EVERY SATURDAY BY

THE W. J. JOHNSTON COMPANY, Limited,

168-177 POTTER BUILDING, NEW YORK.

Established 1874. Incorporated 1889.

W. J. JOHNSTON, Prest. C. E. STUMP, Treas. and Bus. M'g'r.

Telephone Call: Murray 586. Cable Address: "Electrical," New York.

T COMMERFORD MARTIN and JOS. WETZLER, M. E., Editors.

WM. A. ROSENBAUM, Editor Patent Department,

WALTER T. HUNT, Advertising Department.

New England Office, 8 Cook Building, Boston.

W. IRVING BARKER, Manager.

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Subscriptions and communications relating to **advertising** or the **business department** should be addressed to

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Potter Building, New York,

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"THE ELECTRICIAN" IN THE UNITED STATES

AND "THE ELECTRICAL WORLD" IN THE UNITED KINGDOM

Arrangements have been made by which the London "Electrician" can be obtained from THE ELECTRICAL WORLD *office, 168-177 Potter Building, New York.*

The rate of subscription (payable in advance), including postage, is $6 per annum to any address in the United States, Canada, Mexico or other foreign country.

Single copies, price 10 cents, can also be obtained at THE ELECTRICAL WORLD *office. Similarly* THE ELECTRICAL WORLD *can be obtained in England at the office of* The Electrician, *1 Salisbury Court, Fleet Street, London, E. C.*

The rate for English or foreign subscribers (payable in advance) £1. 1s

VOL. XIII. NEW YORK, MARCH 23, 1889. No. 12.

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A St. Louis Exhibition. THE success of the recent electrical exhibition at Chicago was so great that St. Louis is now anxious for something of the same kind, and the directors of the St. Louis Exposition propose to hold an extensive electrical exhibition next September for a period of six weeks. No charges are to be made for either power or space, and a large hall will be placed specially at the disposal of exhibitors for the practical demonstration of electrical applications. This strikes us as an excellent opportunity for reaching a large section of the West and South, and it will no doubt be freely availed of.

"Electrocute" or "Electrocide"? SOME of the papers are amusing themselves just now with a discussion of the best and proper word to adopt for the new means of electrical execution. In this quarter "electrocute" is preferred; and in that, "electrocide." Our readers may have a third choice in the matter. We have none, but think that "electrocution" is a good enough death for any coiner of these absurd words.

The Edison Patent in Canada. IN view of the importance of the recent decision invalidating the Edison lamp patent in Canada, we publish the text in full this week. The Commissioner of Patents held, as will be seen, that although lamps had been made in the Dominion by the Edison Company, they were not made from "raw material," as required by the law, and hence the patent must be forfeited. The question has now arisen as to the effect on the corresponding American patent of the lapse or extinction of the Canadian patent. Recent pronouncements by the United States Supreme Court on the subject are not as clear as they might be, and probably the Court will again be asked for a decision on the specific point.

Extensive City Lighting. IN our columns this week will be found some interesting details as to the recent awards for electric lighting at St. Louis. The contracts call for over 2,200 arc lights and about 4,000 incandescents for public buildings, etc. The expenditure represented reaches more than $250,000 a year, which must be accepted as very strong evidence of the appreciation of electric lighting in St. Louis, which now promises to be the best lighted city in the Union. It is interesting to note that, of the awards in question, over $80,000 is for the incandescent service. We do not know of any other such large contract of the kind anywhere, and have no doubt that many local companies would be glad to have a like chance, though they would probably like better quotations than some of those obtained in St. Louis.

Storage Battery Tests. IN another column will be found a report of an interesting series of tests made by the Johns Hopkins University of the Detroit storage battery which has recently come into prominence. It will there be noted that when handled in the manner in which the battery was designed to be treated the efficiency reached as high as 75 to 80 per cent., and even when subjected to charges and discharges far beyond those for which the batteries were calculated they have stood the strain without apparent deterioration. This is certainly a good showing for an electrical apparatus of a species which has suffered in the past from the failures which necessarily accompany the introduction of every new device, but which has now happily arrived at a stage of perfection that certainly entitles it to recognition as commercial in the full sense of the word.

What is Electricity? THIS question has from the very beginning given rise to speculation in the minds of all who have bestowed attention on the subject, but even the brightest intellects of the present day are themselves unable to furnish a satisfactory answer. The prevailing theory, however, in which the ether is brought into consideration as the medium of transmission for electrical disturbances, has given the best satisfaction of any thus far proposed, but discontent lurks in some quarters, and there is a desire to seek for other means of explaining the phenomena of electrical action. In another column a contributor seeks to overcome the objections by reducing all electrical action to a chemical origin, and the manner in which the idea is followed out will prove of interest, if not conclusive. The idea embodied by Mr. Salom would give rise to the inquiry whether, as a fact, the molecules of water are thus disassociated in the upper regions of the atmosphere, and in the absence of any proof of this fact, we are not inclined to believe that such is the case. The theory of Mr. Salom would also require more proof in other directions, and hence we take it as the expression of an idea rather than as the enunciation of a working theory.

Iron vs. Copper. THE great difference in electric conductivity between copper and iron has practically debarred the latter from use as an electric conductor in the past. But occasions may arise in which this inequality disappears when the relative cost of the two for the same conductivity is taken into consideration. This is forcibly brought out in the application of an iron conductor for the transmission of current on the Ninth avenue elevated railway in this city which is now being laid down by the Daft Company. It would be interesting to know how much the present increased price of copper enters into the calculation as a factor, and whether, even under the old prices, iron would have been found the cheaper conductor. But, on the other hand, even supposing that neither metal presented a particular advantage on the score of cost, it is a question whether iron would not be preferable on account of its greater strength and rigidity. Certain it is, however, that the present high price of copper has affected the production of electrical apparatus, and manufacturers have been limiting their production to the bare necessities of the orders on hand. There is immediate prospect of better times, though, in the breakdown of the French copper "corner," which appears now to be in the last stages of failure.

The Genius of Ericsson. THE world of invention has just sustained a heavy loss in the death of John Ericsson, at the advanced age of 86. Ericsson's life not only spanned the nineteenth century, but his work made a deep impress on the course of events from the time when he competed in England with Stephenson down to the memorable days when the "Monitor" vanquished the "Merrimac." In more recent years he has been as active as ever, but his ideas have not fructified so readily or with such direct practical benefit. It is a pity that a man of Ericsson's swift perception and ability to apply new forces did not grasp the possibilities of electricity and put the electric current to novel uses. But, as far as we are aware, electricity was always a sealed art to him, so far as utilization of it was concerned, although he realized that to turn his solar engine to the best account he must employ electricity as the storing agent. It seems singular to us that Ericsson should not have mastered the principles of electric action, as he did those of steam and heat, and while we do not point in criticism to the absence on his part of an appreciation, as an inventor, of the value of electricity, we cannot help thinking that with the aid of electricity he might have better carried out some of the pet conceptions of his genius. Still it was glory enough for one man to have beaten Stephenson and to have been among the foremost saviors of the Union.

City Electric Light Plants. THE idea that it is wise and well for cities to own and operate the electric light plants that furnish current for their street lamps has proved popular lately in a number of places, but it is not altogether free from opposition. In fact, there are many signs of a healthy reaction from the tendency, and we are glad to see that, in at least one recent case, the better, cooler judgment of the people has prevailed. An interesting and very able argument was made, on March 6, by Mr. A. D. Chandler, in behalf of the Danvers Gas Light Company, before the Committee on Manufactures of the Massachusetts Legislature, with the object of preventing the town of Danvers from using for commercial lighting a plant on which $15,000 was recently spent for the purposes of public street lighting. Mr. Chandler traversed the same ground as that lately gone over by Messrs. Foote and Whipple, from whom he quoted, and he added a number of new arguments—legal, sociological, etc.—against the project, and against the implied and inevitable confiscation of private capital it would involve. Mr. Chandler pointed out that Danvers might as well undertake to operate a shoe factory to supply its citizens with boots and shoes, or engage in the business of supplying milk, coal, steam, heat and bread. "It cost Boston $55,000 for printing and stationery," he remarked, "for the year 1887-8. According to the argument of these petitioners, Boston would be justified in having an act enabling the city to manufacture its own paper, and do its own printing, and thus run in competition with the paper mills on the Connecticut River, and with Boston printers, thereby saving taxpayers the profit on stationery and printing." But perhaps the best point he made was in instancing the course of affairs at Revere. In that place $18,000 was voted for the purchase of an electric light plant, but it was omitted to secure the necessary recorded two-thirds vote at the town meeting. This allowed time for reflection and reconsideration, and when the town convened again to discuss the subject, the proposition was indefinitely postponed by a vote of nearly two to one. Soon after that the two city officials most active in pushing the scheme failed of re-election. Let us have as much electric lighting as possible, but let us also discourage as much as possible the corrupt control of the plants by the cities in which they operate.

Storage Battery Litigation.

As we go to press we are in receipt of the following from Mr. Wm. Bracken, president of the Julien Electric Company:

"The United States Circuit Court for the Southern District of New York has just rendered a decision in the case of The Electrical Accumulator Company vs. The Julien Electric Company for infringement of storage battery patents. The Electrical Accumulator Company sued the defendant on four patents. One patent the complainant abandoned during the trial; two others are decided to be invalid; two claims only of the fourth patent were in controversy. One of these claims, it was held, the defendant does not infringe; the other claim the court holds is too broad in its present form and can be sustained only when limited by a disclaimer to a device which the defendant does not use. The decision is a substantial victory for the Julien Electric Company."

NEW BOOKS.

TRAITE THEORIQUE ET PRATIQUE D'ELECTROCHIMIE. By Donato Tommasi, D. Sc. Paris, E. Bernard & Co., 1889. Part 1, 7 × 11. Price, complete, $6.50.

This work is in many respects worthy of more than passing consideration, as it bears upon its face the evidence of an enormous amount of labor. The author has taken the whole subject of electrolysis and its various modern applications and has gathered together material which was scattered through a great many books and hidden away in periodicals. Beginning with the general principles of the process of electrolysis, the author takes up the question of the identity of high tension current and voltaic currents, and the relation between the two, and defines the various forms of voltameters and the measurement of electric and electrolytic action in particular. He enters here into the influence of temperature on the solution; the distance between the surfaces of the electrodes and its influence, and the quantity of metal deposited, and goes quite fully into the discussion of the rôle which water plays in the process of electrolysis. In this connection also, he discusses the necessary conditions for electrolysis, and adds a list of the different substances which, when dry, are not deposited by the electric current, but which in a state of fusion may be easily electrolized, thus suggesting a ready means, which has already been proposed, to obtain some of the metals by electrolysis which are now considered comparatively rare. The author then goes into the discussion of heat equivalents and the corresponding work of polarization, and discusses other phenomena in connection with the subject, such as secondary electrolysis, electrolytic connection, pseudo-electrolysis and other phenomena of the same nature.

In the second chapter of this work the author takes up the question of motion caused by electrolysis, or electric endosmose across porous and non-porous partitions, and gives the laws of Wiedemann on the transferrence of liquid by the current, and the relations which exist between the transference and the nature of the liquid transferred. He also discusses the movement and attraction of electrodes in voltameters, the electric repulsion of liquids, and the distillation of liquids under the influence of static electricity.

Chapter III. is devoted to a description of chemical combinations and the decomposition produced by electricity in the form of sparks and the voltaic arc. Under this head are described the decomposition of compound gases under the influence of incandescent platinum, the thermic laws of sparks produced by the ordinary incomplete and partial discharge of condensers, the action of the electric spark on vegetable colors, and the like.

One of the principal chapters in the book is devoted to the description of methods of obtaining the elementary bodies by the electro-chemical method. Here the author discusses the atomic weights of the elements, and their electro-chemical equivalents, and the electrolytic divisions into which the metals are grouped; and after referring to a number of phenomena connected with the general liberation of the elements, he passes to the individual consideration of each, beginning with hydrogen and passing through the entire list of the known elements, their manner of preparation, the solutions to be employed and the nature of the deposits obtained.

This ends the contents of the present part. The succeeding parts will contain chapters on the electrolysis of alloys and amalgams, of the various compound minerals, such as the fluorides, chlorides, bromides, oxides, sulphates, nitrates, etc., and also of the hydro-carbons. The final chapter will be devoted to thermo-chemistry, and to the book will be added an index of memoirs on electro-chemistry published from 1784 to 1880, together with the principal works consulted.

TRANSACTIONS OF THE AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Vol. V. Published by the Institute, Temple Court, New York. Cloth, 619 pp., 100 illustrations. 1889.

This handsome and substantial volume just issued by Mr. R. W. Pope, the secretary of the Institute, is a striking evidence of the good work that the Institute is doing in its chosen field. It embraces the papers and discussions from September, 1887, to October, 1888, the authors being Anthony Reckenzaun, Prof. George Forbes, Charles Cuttriss, Wm. Stanley, Jr., Arthur Steuart, Willard E. Case, Dr. Louis Duncan, J. W. Howell, P. B. Delany, F. B. Crocker, Prof. E. L. Nichols, Prof. G. W. Plympton, Nikola Tesla, G. H. Stockbridge, Prof. G. S. Moler, Frank J. Sprague, M. B. Leonard and A. Robinson,—a goodly list, indeed, supplemented by one of nearly seventy other members who participated in the discussions from time to time. This, of itself, would be a fair indication, perhaps, of the activity with which the Institute carries on its labors, but the list of subjects treated is not less significant, embracing as it does electric railways and cars; improvements in ocean cabling; new measuring instruments; alternating current motors; revision of the patent law; the efficiency of incandescent lamps; electric energy from carbon without heat; phenomena of induction coils and lighting transformers; underground work; protection from dangerous currents; the limitations of chemical generators, and many other allied topics.

Supplementing all this is an index of current electrical literature, extending from October, 1887, to July, 1888, inclusive. This index of 172 pages gives, on a modest computation, about 10,000 references to some 3,500 articles on electrical matters published in electrical papers and other technical journals during that period. Many of the references have explanatory notes, and it does not need pointing out that such an index, while useful now, will be simply invaluable as time rolls by. It is practically impossible for any article of importance in the English language on electricity to escape note, and reference work in years to come will be comparatively easy. The Institution of Electrical Engineers in England is now indexing the leading articles in foreign languages, so that the two societies between them are doing a work of the greatest value.

The present volume is well printed and carefully indexed, and has, moreover, an excellent frontispiece portrait of past president F. L. Pope. Such a volume should be in the possession of every electrician and electrical engineer, and we are glad to know that the Institute is pursuing its beneficent career with such steady and solid growth in membership and influence. It deserves the fullest and heartiest support that can be given it.

Electric Propulsion on the New York Elevated Railways.

The recent quantitative experiments with the Daft electric locomotive "Benjamin Franklin," on the Ninth avenue line, have shown such eminently satisfactory results that steps are now being taken to extend the scope of the present service, both as regards distance of transmission and tractive power, and the accompanying view,

NEW DAFT CONDUCTOR, NEW YORK ELEVATED ROAD.

taken looking southward from Fourteenth street, illustrates what has been accomplished up to date. It shows the new conductor, wrought iron and phosphor-bronze, of sufficient dimension for the entire present or prospective work done upon the line that is now being laid, with all possible dispatch, from Fourteenth street southward to Rector.

Before proceeding to a specific description of the conductor, some further allusion to the above mentioned experiments will be of interest. They were for the purpose of ascertaining with the utmost possible accuracy the work done at any instant upon the track in the matter of overcoming rolling and gradient resistance under great variation of speed, load, etc., and of comparing the results with the steam power being developed at the generating station at the same instant.

Traces on cross-section paper of the lines representing the primary steam power, the speed of the train, and the gradient of track—in combination with the known load hauled in each case—open an economic vista in railway propulsion that has only been dreamed of hitherto. The time occupied in putting the train at schedule speed from a position of rest, was, it may be stated, found to average twenty seconds.

The new conductor is of a circular section, 3 inches in diameter and capped along its upper longitudinal element by a bar of phosphor-bronze, an inch wide and three-eighths deep, which assures a polished surface of contact under all conditions of weather. The different expansions of the two metals are compensated for by a proper introduction of slip-joints. The device which secures this beam—no other name seems exactly applicable—in position is a cast-iron clamp five inches in length, enveloping about two-thirds of the circumference and with one side detachable. This is skirted with sloping sides which afford a dry area beneath in all weathers and materially enhances the insulating quality. The next component is a hard-rubber screw-plug tapped into the skirted clamp and followed by a hard-rubber ring, which rests upon a hollow pyramidal base of cast iron surmounted by a strong screw-nipple which taps into the described hard rubber cup and binds all parts in one. A tap bolt from beneath through the sill enters a central boss in the hollow base and secures the whole construction in position.

The change from copper to iron is a purely financial move, as even the sixfold increase of area necessary to preserve the same conductivity still leaves the cost far below that of copper. The special interest attaching to this development of electric railway propulsion lies in its connection with the immediate pressing necessities of the elevated lines, which are indisputably at the ultimate of their carrying capacity under the present—or, in fact, under any, except an electrical—system. More trains cannot safely be run. Larger trains cannot be drawn without heavier locomotives, and these, if steam be used, the structure will not permit. The traffic of last year exceeded 170,000,000 passengers and the average annual increase for recent years has been 15 per cent. There is no promise of relief in any direction except in the superior adhesion of wheels to rails of electric locomotives. Where the track constitutes part of the circuit this is most surprising. While no methodical investigations of it have been made so far as known, due to the general phenomenal obtuseness respecting the importance and scope of this property, it may be stated that the following test in the presence of a number of unimpeachable technical and non-technical witnesses is on record. An artificial gradient of 2,900 feet to the mile was constructed, and a small motor-car carrying a man, and without the advantage of starting upon a level, mounted this, solely under the influence of electrical current and entirely by natural adhesion, as often as desired.

The average steam locomotive on the ordinary track has an adhesion to the rail of 30 per cent. of its weight, with the track either clean and dry or very wet; but this in foggy and frosty weather will frequently be reduced to 15 and 10 per cent. Just what the adhesion of electric locomotives would be under these conditions there are no systemized data to show, but the conviction of its existence is strong enough with the Daft Company to prompt it to construct an electric locomotive of 240 h. p. and 17 tons weight for the purpose of hauling eight loaded passenger cars upon the elevated railways, and its appearance on the Ninth avenue line may shortly be looked for.

Transition Formulæ Between the Electro-magnetic and Electrostatic Systems.

In a paper read by Mr. Blakesley before the Physical Society "On Some Facts Connected with the Systems of Scientific Units of Measurement," he writes:

I do not think a rapid answer could be given by many persons to the question: What is the value in C. G. S. electrostatic units of a current of, say, 33.3 practical electro-magnetic units? Yet in following out the experiments of Dr. Hertz such a calculation must, I think, be made. I will here give two formulæ, which will enable any magnitude given in one system to be brought into the other:

Let k = the exponent of l in electro-magnetic system,
h = " " m " " "
n = " " l electrostatic "
q = " " m " " "

for any kind of magnitude brought into due correlation with others.

Then, to reduce between practical (quadrant-volt-second) units electro-magnetic and C. G. S. units electrostatic:

1 practical unit = $3^{n-k}10^{10n+11q-k}$ electrostatic C. G. S.

To reduce between C. G. S. electro-magnetic and C. G. S. electrostatic:

1 C. G. S. electro-magnetic unit = $3^{n-k}10^{10(n-k)+11(k-q)}$ electrostatic C. G. S. units.

The 3 in these equations is meant as a sufficient approximation to the number 2.998, which is one-tenth of 'v' in quadrants per second.

I have myself not seen such reduction-formulæ elsewhere, and under the present system I think they may be found of use.

Operating Bridge Draws by Electricity.

To the Editor of The Electrical World:

SIR: I notice in a recent issue an article concerning the turning of an iron draw at Bridgeport by electricity, in which it is said that it is believed to be the first of the kind in the country.

I think perhaps that I may claim the credit of having prepared plans for the first draw turned by electricity. The Milwaukee Bridge and Iron Company, over a year ago, contracted with the city of Detroit to build a bridge over the American channel of the Detroit River to Belle Isle, a pleasure resort owned by the city. The contract called for the draw to be turned by steam, but at the request of the Milwaukee company, and in accordance with a change made by the City Council, I prepared plans by which the draw of 300 feet in length is turned by an electric motor of 10 h. p. Everything works satisfactorily, despite the statements of some electrical engineers that it was inadvisable for the work to be done by electricity.

NEW YORK CITY. FRED H. WHIPPLE.

Sperry's Electrical Coal Digger.

At the electrical exhibition held in connection with the late Chicago convention of the National Electric Light Association, there was exhibited a most interesting piece of electrical machinery, in the shape of a coal digger, devised by Mr. Elmer A. Sperry. A machine of this class requires special properties and is naturally subject to rough handling, and these considerations have been specially taken account of in the construction of the "digger."

Our illustration, Fig. 1, shows the machine in perspective, with the motor uncovered; and Fig. 2 shows the machine with the inclosing casing entirely removed, so as to expose the working parts to view.

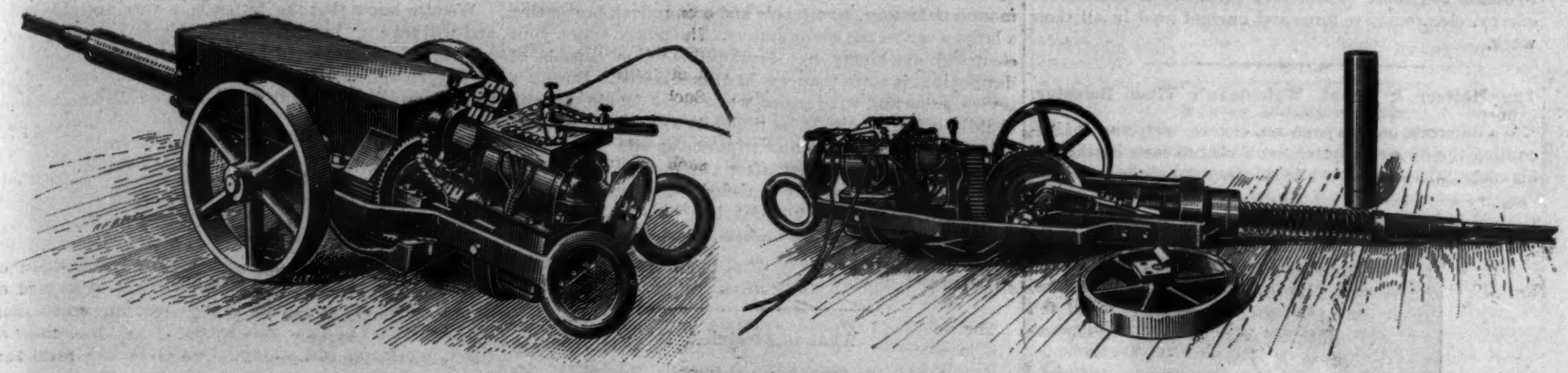
A peculiar, and also important, feature of the machine is that, although the full stroke is six inches, should but four inches be required to strike the bed of coal, the mechanism cuts off the power at this point. This is accomplished by an arrangement such that the projectile is thrown against the bed of coal by a powerful spring, which is shown in the engraving, Fig. 2, but which is covered with the cylinder when in action.

The motor is geared to the cam, which is bound to the projectile by a strap.

As will be seen, when the projectile is thrown out to its full length, the cam is over nearest to it. As it is drawn away the strap draws in the projectile and compresses the spring. The instant the next dead centre is passed the spring throws out the projectile. Now, as the strap is not fastened to the cam, should the projectile be thrown out only four inches, the only result would be that the strap would clear the cam by two inches. As the latter is constantly revolving, it would pick up the strap when it came round to it. This is a great advantage, as usually in such machines the whole length of the stroke must be made, and as a result the machine is pushed backward.

The projectile and pick shown weighs from 60 pounds up, according to the kind of work required. It has a six-inch stroke, and this is delivered with a rapidity varying from 150 to 300 blows a minute.

The motor furnishing the energy was built expressly for this purpose by Mr. Sperry, and has an efficiency of 91 per cent. As will be seen, it is placed on the rear of the machine. It is wired to the dynamos at the opening of the shaft, and by this means power is supplied to it.



FIGS. 1 AND 2.—THE SPERRY ELECTRIC COAL DIGGER.

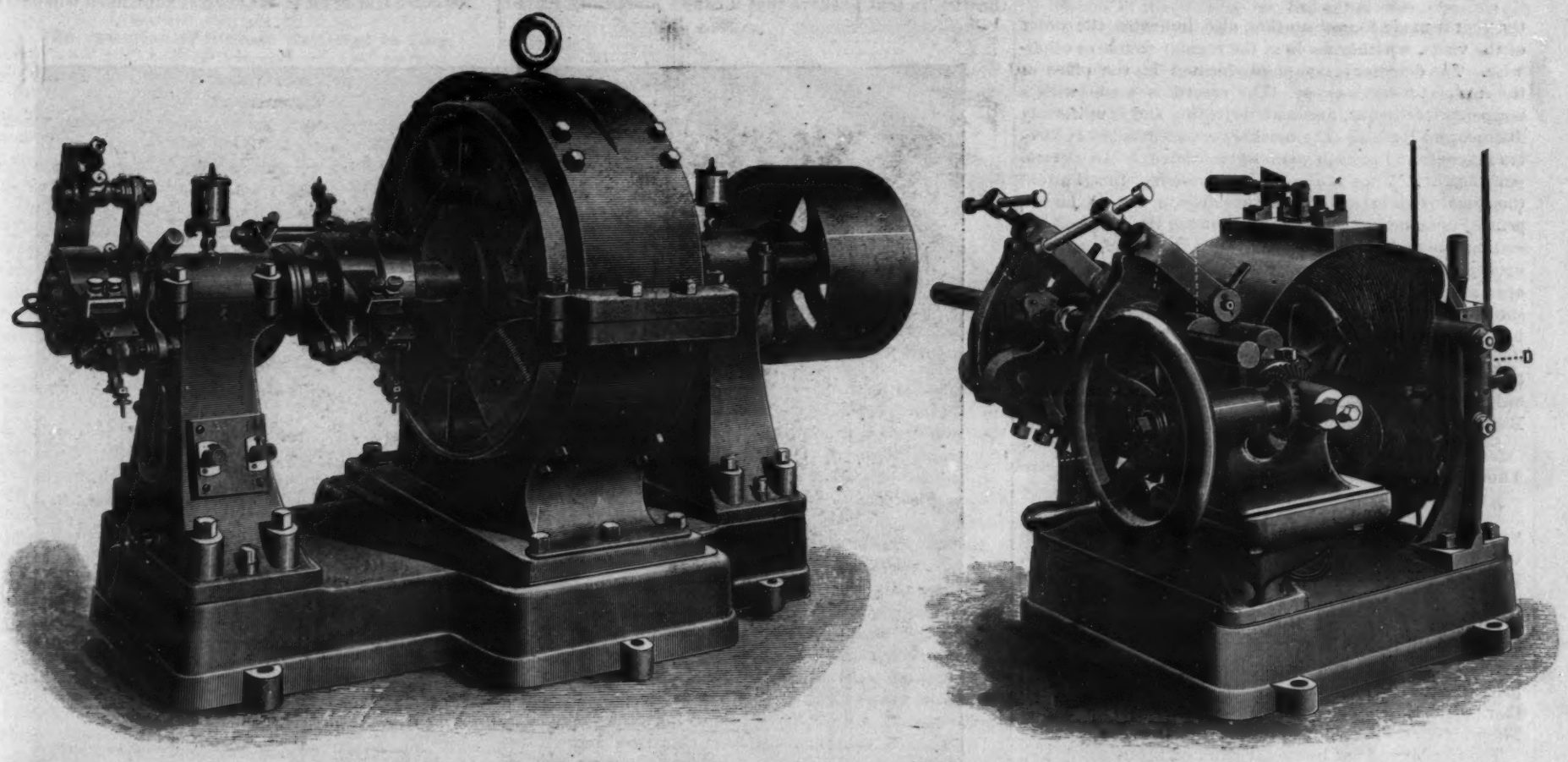
Thomson's New Welding Transformer and Dynamo.

Since the first application of the electric current to welding, Prof. Elihu Thomson has modified his apparatus from time to time, as experience proved advisable; but in all the same essential principles have been retained. The apparatus, as already known to our readers, consists of an alternate current generator, which furnishes current to a transformer, the latter changing the generator current of small volume to one of enormous volume adapted for welding.

The latest developments in the welding machinery are shown in the accompanying engravings. The currents are supplied by an alternating current dynamo of peculiar and original construction, shown in Fig. 1. The winding of the fields and armatures has been so arranged as to cause the machine to "build up" the fields with great rapidity. The object of this is to save time, as the loads are thrown on and off constantly, and very frequently it becomes necessary to have a rapid picking up of the fields in order that no time may be lost, as would be the case with a dynamo as usually constructed. So rapidly do the fields "build" that in welding a 2-inch piece, from the moment the rheostat is set until the fields have become saturated, requires but two seconds. The bearings of the machine are unusually long, and the commutator is on the same end of the armature shaft as the collector rings, but outside of the bearing. This arrangement obviates the necessity of having a long length of shaft between the armature head and the bearing on which the shaft rests.

The armature is made of laminæ of sheet iron insulated with tissue paper. The fields are made of alternate laminæ of cast iron and wrought iron, insulated from each other in a similar manner. All the parts of the machine upon which strains are brought are made heavy and the whole apparatus is exceedingly compact. The machine is wound for 300 volts potential, and the dynamo having a capacity sufficient to supply current for welding 2½-inch solid iron, will give 125 ampères at this voltage, provided it is desired to bring on the welding heat with great rapidity.

The transformer or welding coil illustrated in the engraving Fig. 2 has a capacity for welding round iron bars 1¼ inches in diameter. It consists of a core of iron composed of round discs with holes punched in the centre. These are bolted together thoroughly by brass bolts to prevent opposing magnetic fields. Inserted into the hole in the middle of the core is a copper tube which forms the secondary of the transformer. The primary coils are wound through the secondary and around the core at right angles to the surfaces of the discs, as will be seen in the illustration. The only active portion of the secondary is the tube above mentioned, the currents generated therein being carried by means of heavy copper conductors to the clamps which are on the front of the machine and which are seen on the left in the cut. The operation of the clamps is such that when pressure is applied by means of the hand wheel shown, the weld is completed and the joined pieces can be removed in from four to five seconds. The currents are received from the dynamo at the back of the welding machine, as shown at the right in the illustration, and the primary circuit can be broken by means of the double throw-switch shown on the top of the core of the machine. In operating, it is generally the custom to set the rheostat, which is properly marked, at the right point for the size of material which is to be welded, and to close the circuit by means of the switch. The machine begins to build instantly, and as soon as the metal at the point of contact has reached the proper temperature for welding, the switch is thrown, thus "breaking" the fields.



FIGS. 1 AND 2.—THE NEW THOMSON WELDING GENERATOR AND TRANSFORMER.

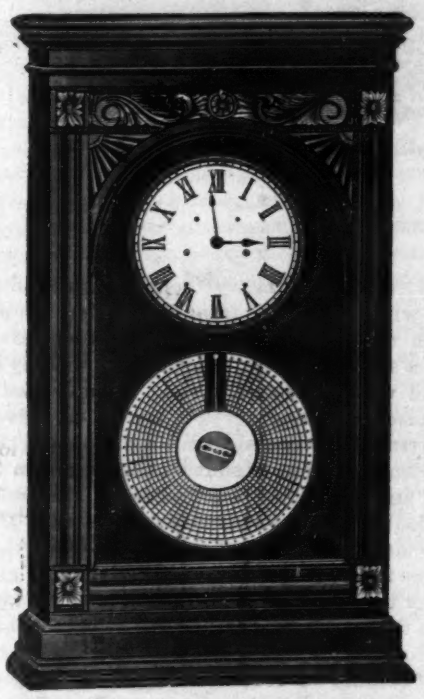
It would be expected that the energy required to weld different sizes of the same metal would be proportional to the area of the cross section of the pieces, but this is not found to be actually true, nor even so nearly approximately true as to warrant a general statement. It is expected, however, that after the completion of a long series of experiments, which have been and are now being carried on, that some law governing the amount of energy required to weld the different sizes of the same material will be discovered. It is found that in welding ½-inch wrought iron about 10 horse-power is required for 8 or 10 seconds. In welding 1-inch iron 20 horse-power is required for 40 seconds, and the relation of horse-power and time to other sizes of materials does not seem to be any more definite than in the examples given. The energy represented is

of course, mainly accounted for by the volume of the current flowing, the voltage being exceedingly low. For instance, in welding 1-inch iron, between 7,000 and 8,000 amperes are necessary at considerably less than a one-half volt pressure. Indeed, the pressure is so low that it becomes extremely difficult at times to measure it, while the current is of such immense volume that the difficulty of measuring is often greater than with the electromotive force. The volume of current also depends upon the shape of the abutted ends of the pieces.

The Thomson Welding Company has instruments under process of construction with which they expect to be able to obtain the most satisfactory results in measuring the energy, electromotive force and current used in all their work.

The Holtzer & Cabot Watchman's Time Detector.

We illustrate on this page an electric detector for recording the time of a watchman's visit to each locality on his route. The record, while showing the time at which



HOLTZER & CABOT WATCHMAN'S TIME DETECTOR.

the visit is made to each station, also indicates the order of the visits, whether made in the regular course or otherwise. The detector is commonly located in the office or the superintendent's house. The record is made with a tempered steel point, needs no adjusting and is uniformly distinct and legible. The markers are actuated by an electro-magnet, and in each room to be visited is an electric push button. Upon the watchman pressing this button, the armature is attracted, which causes a dot to be imprinted upon one of the squares, showing the time and the station which is visited. The door of the clock cannot be opened without mechanically recording the time of the opening. The record is replaced each morning by a clean sheet. The record cannot be effaced; the paper being punctured at each pressure, tells the story of each visit in its order. Should the watchman fail to make his visits at the proper time, the fact is made prominent upon the record sheet. The detector is made by Holtzer & Cabot, of Boston.

The Thomson-Houston Electric Road at Syracuse, N. Y.

We illustrate on this page the Third Ward Street Railway which was equipped by the Thomson-Houston Electric Company, and has been in operation since Nov. 29th, 1888. This line comprises three miles of single track with the necessary turnouts. It runs through Genesee St., the principal residence thoroughfare in Syracuse, and terminates in the business centre of the city. There are nine curves on the line, three of which are reverse. Overhead construction has been used throughout. At present there are eight cars in use, two equipped with two 15 h. p. Thomson-Houston motors, and six with two 10 h. p. each.

The station and car house are situated about a mile and a quarter from the centre of the city, and directly on the line of the road. The power plant consists of two 80 h. p. Thomson-Houston generators, and two 80 h. p. Armington & Sims engines and boilers, having a total capacity of 250 h. p. During a severe snow storm which visited Syracuse some time ago, the motor cars were the only ones to operate on schedule time. This road has run without a hitch of any kind since it was first started. Its patronage has greatly increased, and to-day it is the most popular road in the city. The following letter was received recently from Mr. W. A. Wales, president of the road: "Our road being equipped with your system of electricity, was opened for traffic Nov. 29, 1888; and after having given it a thorough trial to date, experiencing all kinds of weather (and some days most trying) we are pleased to be able to state that we have not been at any expense for repairs or maintenance of any important parts of the machinery, the few minor mechanical difficulties that are liable to occur to all new apparatus of this nature having nearly all been overcome; so far at least, that we do not hesitate to say, that we consider your system a practical and financial success, and that we are greatly pleased with its workings. We are now operating only about two miles of our road, running only five cars, each of them making about 80 miles per day; we can easily increase the mileage, and when we operate the entire length of our road each car will make about 89 miles per day. We have given a trial to both the copper and carbon brushes, and are now using exclusively the carbon, as we consider them much more satisfactory, serviceable and economical, preventing a large wear on the commutators. The power which your electrical machinery has developed, and is capable of developing, is more than we had anticipated. During a severe snow and wind storm, when horse cars in this city could only be run with great difficulty and slowly, we were able to maintain our regular trips and speed. In conclusion we would say, that after two months' experience with this system, we are satisfied with this system of motive power, and we congratulate ourselves that our cars are not propelled by horses, as we find the expense much less by electricity than by animal power, and it gives greater satisfaction to the travelling public."

What is Electricity?

BY PEDRO G. SALOM.

The study of the subject of electrical accumulators, a paper on which I recently presented before the American Institute of Mining Engineers, has given rise to a number of speculations as to what electricity is, and one of which is so important, if true, that I feel inclined to state it at once, rather than wait for time to make confirmatory tests of its truth or falsity. I refer to the theory of lightning.

For a long time we have had in chemistry the names of two mysterious elements or compounds or forms of oxygen called ozone and antozone, and while there may be very good grounds for the belief in the existence of these elements or substances, I have never met a chemist in my 15 years' experience, who ever saw an ounce of ozone, or knew how to prepare an ounce; and as to antozone, that is still more hypothetical.

Now, I have a very simple theory in regard to this matter, which I think explains all the facts, or most of them, and which enjoys the great advantage over most theories, in that I believe that it can be practically proved or demonstrated. My theory is, that the molecules of water by being expanded when dissolved, in the air, and reaching a still further degree of expansion by reason of the heat absorbed when in the form of clouds and in the rarefied atmosphere of great altitudes, reach a point where the well known phenomenon of dissociation begins; and that they are broken up into their original elements, hydrogen and oxygen, or into hydrogen and hydroxyl, which is the water radical having an affinity of one, or acting in other words like a monad element. This I believe is the mysterious ozone, so called, and furnishes the remarkable properties that ozone is said to exhibit, viz., a superior property or ability for oxidation over ordinary oxygen.

For example, if we take two molecules of hydroxyl and combine them, we form water and oxygen, thus: $HO + HO = H_2O + O$; or oxygen in the free or nascent state which exhibits superior oxidizing characteristics.

Now let us examine what takes place in thunder-storms, on a hot day in summer, when they usually occur. At that time the air is sur-charged with moisture owing to its heated condition, and a degree of expansion takes place until the water is dissociated by rarefaction and we have instead of clouds mysteriously charged with positive and negative electricity, which we know nothing about, hydrogen and oxygen, which we do know something about, or hydrogen and hydroxyl.

We also know that the latter is a very unstable body, and will take up hydrogen to complete the water molecule, or two molecules of hydroxyl will give up one atom of oxygen and thereby form the water molecule. It is, also, a powerful oxidizing agent, like so-called ozone, and, under certain conditions, this remarkable substance, which has been so little studied, is a reducing agent.

This can be illustrated graphically as follows:

$$HO + H = H_2O;$$
$$HO + HO = H_2O + O;$$
$$MnO_2 + 2\,HO = MnO + H_2O + 2O.$$

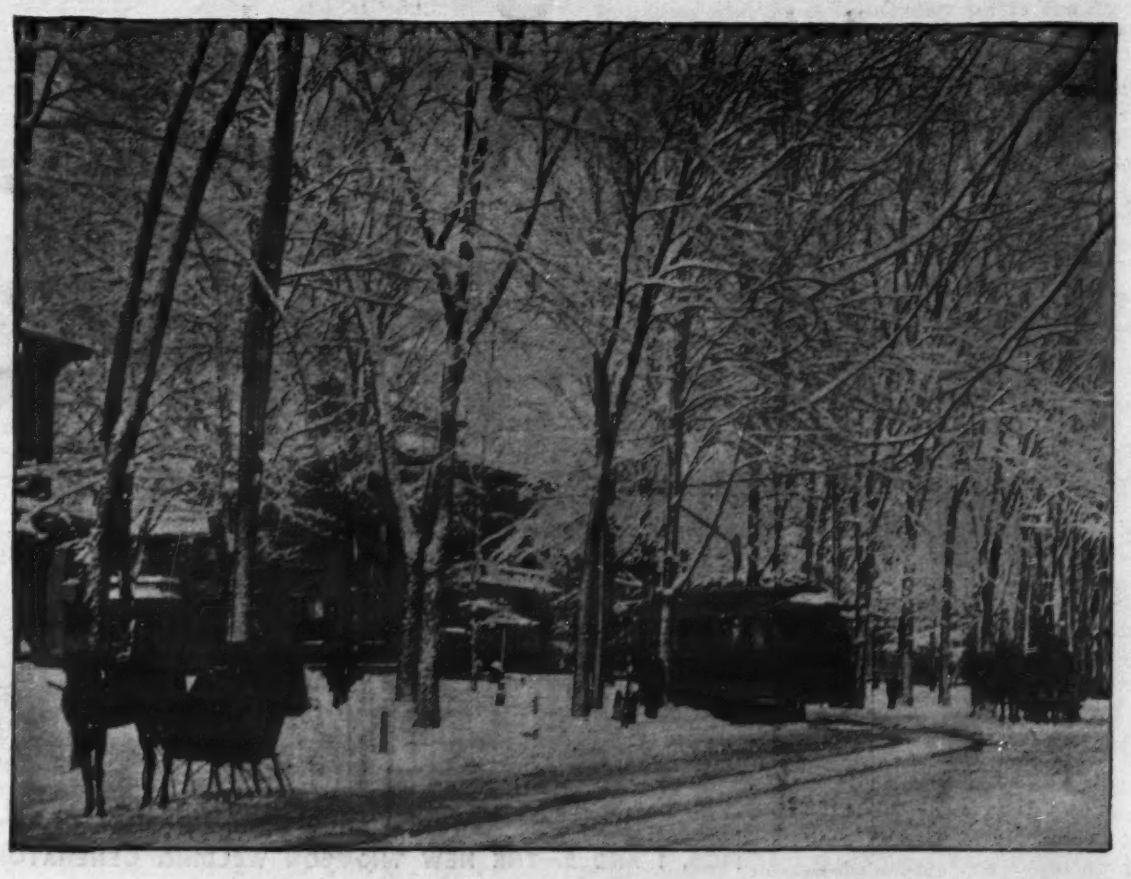
We have only to assume the energy of combination of these two gases to be set free as electric energy instead of as heat, in a manner similar to the energy of combination of the elements of a galvanic battery. The molecules of gases, in other words, arrange themselves like little batteries, and we can assume by their polarization an almost indefinite number of them in series accounting for the high potential in lightning up to thousands of volts if necessary, and at the same time a relatively small amount of current, owing to the fact that the actual amount of water produced, or involved in the discharge, is really comparatively small.

When we consider that the E. M. F. derived from the chemical affinity of a single atom of oxygen for two atoms of hydrogen is 1.5 volt, or is equal to 7,144 foot pounds, we have all the necessary data to account for the gigantic force and destructiveness of lightning; we know, moreover, that after a very severe stroke of lightning the rain fall for a short time is heavier.

Now to liberate .00001022 gramme of hydrogen requires one coulomb or one ampère-second; consequently one gramme of hydrogen will require 97,847 coulombs, and 454 grammes or 1 pound will require 44,422,538 coulombs or 12,340 ampère-hours at 1 volt, or 18 electrical horse-power hours, or 25,640,000 foot pounds.

100 cubic feet of air at 100 degrees Fahrenheit will hold a little over .25 pound of water vapor. Therefore, 400 cubic feet will hold 1 pound and as water contains 11 per cent. of hydrogen it would take about 4,000 cubic feet to furnish the hydrogen necessary to account for the energy.

The assumption of the existence of the hypothetical ether is unnecessary, and, I believe, mathematically unsound. It is the old phlogiston theory of Stahl bobbing up serenely after having been laid to rest for over 100 years by the brilliant discoveries of Lavoisier. Moreover, it does not help us in the least. The old question still remains. If ether is necessary for the conduction of light, heat and electricity, what is it that conducts between the atoms of ether? Surely, the philosophers don't mean to tell us that ether is absolutely solid, or, in other words, not



AN "IMPRESSIONIST" PICTURE OF THE THOMSON-HOUSTON ROAD, SYRACUSE, N. Y., UNDER SNOW.

made up of molecules or atoms. If it were, where would poor, ordinary matter, which we so much despise, but which in reality we know so little about, come in? If space is solid ether, how can there be any room for matter? Is it not better to try to find out something more about the things we have with us, than to invent mysteries absolutely inconceivable?

The above theory in my judgment, establishes electricity on a thoroughly chemical basis. No ether, no mysterious fluids of positive and negative character, no *immaterial material* such as phlogiston or caloric (merely names invented to conceal our ignorance) is necessary any longer to account for the phenomena. Therefore, I can repeat more forcibly than ever the definition which I gave in a short lecture at the Franklin Institute two years ago, that "electricity (or perhaps more properly speaking, E. M. F.) is the mechanical expression of chemical affinity."

This is a subject of such far-reaching importance and of such a high scientific value that it would be presumptuous for me to indicate, even if I were able, the great questions involved in a true understanding of the subject.

The Insertion of Storage Batteries in Cars.

To the Editor of The Electrical World:

SIR: In your issue of March 9, 1889, you gave considerable publicity to an alleged invention of John A. Brill under the title "New Method of Inserting Storage Batteries in Cars." In behalf of the Electric Car Company of America I must ask you to publish the following:

The article above referred to is misleading, as the insertion and removal of storage batteries, on suitable trays or slides, from compartments under the seats through the ends of the cars, is not new, but has been in use by our company on our cars since 1887. Next, the automatic coupling up of the batteries with the motor circuits by the insertion of the batteries is not new, but has also been used by our company since 1887 and is fully covered by our numerous patents. Our company absolutely controls the invention of inserting the batteries through the ends of the car, and Mr. Brill's patent means nothing. I would call attention to letters patent to R. M. Hunter 384,576. June 12, 1888, where this construction is fully set out and broadly claimed. In that patent the following language is found: "In my construction of car for the storage battery I provide the compartment under the seat with an open end, either in front or rear of the car, or at both ends, and such openings are preferably provided with covers or doors. Into this compartment suitable slides or carriages supporting the batteries are run, whereby the batteries may be easily inserted or withdrawn." Also in the specification it speaks of the dash board or guard being cut away to allow the passage of the batteries, and provided with removable parts (doors) which would be turned out of the way when inserting a battery slide. There are fourteen broad, sweeping claims. The eleventh claim will illustrate that we own the invention of putting batteries through the ends of cars. It reads as follows: "The combination in a car, of a seat-compartment running lengthwise of the car, an opening on the end of said compartment, a door for said opening, supports within said compartment, and a removable battery slide adapted to be moved into or out of said compartment through said openings and resting upon said supports."

In conclusion, let me say that the assurance of Mr. J. A. Brill in claiming the specific doors in the dasher is beyond what I thought possible, as he was fully aware that the invention was not his, and was in our designs before he ever heard of a car with batteries removable through the ends. We make all of our cars that way, and Brill never made a car that way for any one but for us on our order. We had not thought it necessary to patent the doors in the dasher, but this only goes to show that, if you do not patent the smallest details, some bright individual, after getting the invention from you, will patent it in his own name rather than allow it to go to waste.

ELECTRIC CAR COMPANY OF AMERICA,
PHILADELPHIA, March 8, 1889. R. M. HUNTER, M. E.

Mr. Frank Ridlon Vindicates Himself.

To the Editor of The Electrical World:

SIR: I beg to trespass upon your time that I may bring before the electric light fraternity, more especially those who attended the late convention in Chicago, an explanation, or, I should say, a vindication, of what I said on the floor of that convention the second day of its session, regarding the condition of underground wires in Boston, and their connection with fire risks, and also the difficulties which have been met in our relations with the insurance companies in regard to their considering electric lights an extra hazardous risk. I stated at that time what I then believed, and now know to be the truth, that a large portion of those fires resulted from a system of underground wires. This fact was proven in a paper read by Col. Hewin at the last meeting of the New England Exchange. It was also fully proved and admitted by the insurance people at a meeting of the representatives of the Boston Board of Fire Underwriters, and representatives of the electric light interest in Boston. I also know several prominent electric light men who state that the inspectors of the Boston Board of Fire Underwriters had reported to them verbally at different times that the late increase of fires from electric lighting came largely from the underground system. At the meeting above referred to of the New England Electric Exchange, a number of those fires were discussed, and from the best information obtained, they resulted directly or indirectly from the underground system. I refer to these matters because, on the third day of the convention, a gentleman representing the insurance interest of Boston, stated in a speech before the convention that what had been said the previous day in regard to fires from electric light appliances originating from the underground circuit, was not true, that such was not the fact. Therefore as I look upon it, I to-day stand impeached before that association either as not being well informed as to the state of affairs, or as stating a deliberate falsehood; and as I do not care to remain quietly under either of the accusations—being ready at any time to prove my assertion—I will thank you to insert this in your columns, thinking that following so closely on your report of the Electric Light Convention, it will reach many of the same readers. I will further add that I hold myself in readiness to meet the accusations above referred to publicly, and I will take measures to bring the same before the National Electric Light Association at its next convention.

BOSTON, Mass. FRANK RIDLON.

FIG. 1.—THE SPRAGUE ELECTRIC ROAD, WILKESBARRE, PA.

Making Induction Coils.

To the Editor of The Electrical World:

SIR: Can you give me any information in regard to a Ruhmkorff or intensity coil? I would like to know how many layers of primary wire, the gauge number of wire, the length of coil and size and length of secondary wire; and what is used to insulate the secondary wire from the primary. I have the book "Induction Coils, How Made and How Used."

On page 54, article 54, it says: "2 layers of No. 16 cotton covered wire for the primary." I hardly think that is enough. I am making a coil for myself, and have the base, condenser, commutator, contact-breaker, done and am now embarrassed. I want to get about 1 in. or 1½ in. break spark if possible. If you can give me any information in regard to this subject I would be very greatly obliged to you.

JOHNSTOWN, PA. JOHN A. STATLER.

ANSWER: The directions given, "2 layers of No. 16 cotton covered wire for primary" is probably correct if the secondary is made in accordance therewith, say, of 1 pound No. 40 B. W. G., with a core 6 inches long and 1 inch in diameter. The primary is best insulated from the secondary by an ebonite tube thicker at the ends than at the middle. This tube can be solid or built up of thin ebonite sheets.—EDS. E. W.

Sprague Electric Roads at Wilkesbarre, Pa.; Steubenville, O., and Asheville, N. C.

We illustrate herewith in Fig. 1 two electric cars on the Wilkesbarre & Suburban Railroad, from which a very good idea of the Sprague method of overhead wiring can be obtained. This road is one of the earliest which was installed by the Sprague Company, and it has been in operation for about 10 months. The first installment of cars was three for operation over two miles of track, but the success of the road has been so great that the railway company has ordered a duplicate equipment from the Sprague Company.

FIG. 2.—ELECTRIC ROAD FOR PASSENGERS AND FREIGHT, ASHEVILLE, N. C.

Fig. 3 (page 176) shows one of the Sprague electric cars in operation at Steubenville, Ohio, passing under a railroad bridge on the route of the road. The picture gives a very good idea of the wide range of movement of the trolley-arm, which can reach from 12 to 14 feet above the car to less than 1 foot when the location of overhead wire demands such a wide change. The kind of trolley-pole used upon this road is extremely light and unobtrusive, consisting of simply a light, hollow iron rod carried on top of

the car and supported from the car by a stout steel spring, which allows it to move in every direction necessary. The equipment of this road includes the regular Sprague system of overhead wiring, with main and working conductor running parallel, connected at intervals of every 100 to 200 feet. The road has been a success from the start, and has carried a large number of passengers. It has been inspected by a great many street railway managers from Ohio, Indiana, Kentucky and Western Pennsylvania, who have visited Steubenville for the purpose of witnessing the operation of the road, and who have expressed themselves as very well pleased with the operation of the electric system.

Fig. 2 is a view taken from a photograph of the Asheville, N. C., Electric Railway. Asheville is a flourishing mountain town, noted throughout the country as a health resort, and it is characteristic of such a town and its enterprise that it now has an electric railway, first class in all particulars, which gives the people perfect and comfortable means of transit to the depots and hotels, and replaces the old springless hacks and primitive omnibuses.

The picture shown is from a photograph taken shortly after the opening of the road, and represents three of the Sprague electric cars turning a corner into the main street of Asheville, N. C., and it is an interesting feature to notice that it is difficult to discern the overhead system at all on account of the smallness of the Sprague overhead wires. Besides an equipment of passenger street cars this electric railway also possesses several freight cars, operated by Sprague motors, and as this road connects the depot of the North Carolina Railroad with the city of Asheville, these freight cars have proved a great convenience and a source of considerable income to the managers of the road.

FIG. 3.—SPRAGUE ROAD AT STEUBENVILLE, O.

Extensive Electric Lighting in St. Louis.

The city of St. Louis has lately been the scene of active competition for the new electric lighting to be done there, and the awards by the special committee of the Board of Public Improvements have just been announced. We quote the following from the St. Louis *Republic*, which after stating that Mr. Charles Sutter will put in an Indianapolis Jenney plant under his contract says:

"The plant is to be one of the largest ever constructed in the world, and will cost at the lowest estimate $750,000. The ground has already been secured in a central portion of the city, and on the line of one of our large railways. This will give them every facility for handling their material without the necessity of draying it. The item of coal alone is a large one when the fact is considered that the consumption of that commodity will aggregate 100 tons per day, or 36,500 tons per year. The construction will give employment for eight months to 1,000 men in various capacities, and when the actual work of lighting begins 250 men will find steady work.

"The Indianapolis Jenney Company and the New York Electrical Accumulator Company, whose respective systems will be brought into use, have already increased their capacities, and are now in a position to go to work immediately.

"The plant will be capable of maintaining 4,000 arc lights of 2,000 c. p. each, and 10,000 incandescent burners of the accumulator system. Of the 4,000 arc lights 2,226 will be used for lighting the streets, as stipulated in the contract, and 1,774 for private use in commercial buildings and elsewhere. Of the 10,000 incandescent lights more than 4,000 have already been disposed of, and the company say that they can give a light greatly superior to gas and at an equal cost, still realizing a handsome profit. In the construction of their lines over 300 miles of wire will be used, and negotiations are now pending to supply it. Twenty miles of this will be placed in underground conduits and the remainder strung upon poles. The arc lights will consume 3,000,000 carbons a year, which, at a cost of $10 per 1,000, will reach a cost of $30,000. Their revenues from their contract with the city will be $166,439.50 a year, which, together with their receipts from private lighting, will bring them in about $300,000, from which they expect to realize a handsome profit.

"The whole enterprise will be under the superintendence of Mr. D. J. Harris, who is now consulting engineer and manager of the Accumulator Company. He has had an experience of 17 years as an electrician, during which time he has, at different periods, been in the employ of the governments of France, England, Germany and Italy. Among other things Mr. Harris is now completing arrangements for a universal electrical exhibition, to be held at the Exposition Hall in this city, commencing Sept. 4 of the present year, which will continue for a period of six weeks. The announcement has been made that no charge shall be made either for power required or space occupied to exhibitors whose application shall have been received prior to April 15."

We may add that the awards were: to Mr. Sutter for arc lighting, $84,780 50 and $81,659; to the Missouri Electric Light & Power Company (Westinghouse) for incandescent lighting $50,525; to C. A. Brown (Western Electric) for incandescent lighting, $33,327.80.

Lighting at the Inauguration Ball.

The Thomson-Houston Electric Company deserve great credit for the very satisfactory manner in which they carried out their part in the inaugural ceremonies.

It was late in January when their representative, Mr. James R. Magee, secured the contract to furnish the light necessary for the inaugural ball. The only plant in the Pension building was at that time four 60 h. p. boilers (low pressure) used only for heating purposes. It was found necessary to install one 100 h. p. engine, which was kindly loaned for this purpose by MacIntosh, Seymour & Co., of Auburn, N. Y. The original plant as asked for by the committee consisted of some 800 incandescents inside the building and 15 arcs outside. After various changes, suggestions and orders by the Committee on Decorations, the plant on the night of the ball consisted of 1,096 incandescent lamps, 6 arcs inside the building, and 20 arc lamps in the three entrances and outside the building (including one on the roof), requiring a capacity of fully 125 h. p. to operate these lights, which was secured from the engine with the assistance of a condenser furnished by L. Schutte & Company, of Philadelphia.

It is a remarkable feat to take a new engine, which had never been put together until its arrival in Washington, and have it perform the excessive duties required of it on that occasion. During the entire run of the plant on the evenings of March 4 and 5, the inaugural ball on Monday night, and grand promenade concert Tuesday evening, there was not a hitch in the proceedings, not a light having given out, proving conclusively the perfect construction and regulation of the electrical apparatus, together with first-class wiring and construction work.

This installation was made by Mr. G. H. Almon, under the supervision of the Isolated Lighting Department of the Thomson-Houston Electric Company. The committee were profuse in their thanks for the able manner in which the contract for lighting both ball-room and grounds had been carried out; and a general topic for conversation among those in attendance at the ball and concert was the brilliancy and beautiful display of the electric lights.

The lights were distributed as follows: 12 16-incandescent chandeliers of 64 lights each; 80 16-incandescent, in Japanese pagoda, where the band and orchestra were stationed; this was in centre of hall; 152 16-incandescents were placed in the arches, one light in each; and 96 16-incandescent placed in chandeliers in the six supper rooms, there being 16 lights on each.

The 12 chandeliers in the main hall were made specially for this occasion, as the committee could not find any large enough to meet their requirements.

Each chandelier was 34 feet in length, supporting at its lower extremity a circle 12 feet in diameter, having 40 16 c. p. lights, and 19 feet above this was another circle 9 feet in diameter, with 17 16 c. p. lights. At the top of the chandelier was a crown bearing seven colored lights. These fixtures were designed by the Thomson-Houston isolated department. The arc lights in use were of 2,000 c. p.

Death Current Experiments by the New York State Authorities.

The object of these experiments which were made on March 12, was to determine the best points of application, duration of contact and electromotive force of the alternating current, for executing condemned criminals by electricity. Current was derived from a Siemens alternating current dynamo whose field was separately excited; a rheostat was provided for varying the electromotive force from 100 to 1,000 volts. A Cardew voltmeter with resistance of similar wire in its circuit was used to measure the pressure, and a series of incandescent lamps was connected in parallel with the same to check the reading.

1. Small white cur; weight 21 pounds. Connections from right fore leg to left hind leg, using cotton waste saturated with solution of zinc sulphate with density of 1.10, held in place by wrapping with bare copper wire. In all experiments the electrodes were saturated with the same solution. Resistance, 2,700 ohms. Contact for 10 seconds under 100 volts pressure at 2.46 P. M. Died without sound or struggle.

2. Large black mongrel Newfoundland dog; weight, 87½ pounds. Connections from brass plate electrode 4½ × 6 inches, covered with felt ¼ inch thick, placed on middle of forehead; second electrode on right hind foot in same manner as in previous case. Resistance 2,200 ohms. Contact for 15 seconds under 800 volts pressure at 3:12 P. M. Died instantly without sound or struggle.

3. Liver-colored mongrel bird dog; weight 60 pounds. Plate electrode on back of neck and wire electrode on right hind leg. Resistance, 2,200 ohms. Contact for 10 seconds under 700 volts pressure at 3:41. Death instantaneous without sound or struggle. Resistance after death, 250 ohms.

4. Small yellow dog, weight 35 pounds. Plate electrode on forehead and wire electrode on right hind leg. Resistance, 470 ohms. Contact for 10 seconds at 500 volts pressure at 4.01 p. m. Died without sound or struggle. Resistance after death, 488 ohms; increase probably by drying out of solution under wire electrode, as same steamed during time of contact.

5. Calf, weighing 74 pounds. Connections from right hind leg to plate electrode on back of neck; hair saturated with solution but not clipped. Resistance, 500 ohms. Contact for 15 seconds under 800 volts pressure at 4.22 P.M. Died without sound or struggle.

6. Calf, weighing 102½ pounds. Connections from plate on forehead to right hind leg. Resistance, 550 ohms. Contact for 20 seconds under 800 volts pressure at 4.44 P. M. Died without sound or struggle. Resistance after death 280 ohms.

7. Calf, weighing 98 pounds. Connections same as with previous experiment. Resistance, 340 ohms. Contact for 15 seconds under 800 volts pressure at 4.55 P.M. Died without sound or struggle. Resistance after death 230 ohms.

8. Calf, weighing 109 pounds. Connections from right fore leg to left hind leg. Resistance, 380 ohms. Contact for 20 seconds at 800 volts pressure at 5:06 P. M. Died without sound or struggle. All of the calves were dressed by the butcher, and were pronounced fit for food.

9. Horse, weighing 830 pounds. Connections from plate electrode on forehead to left hind leg. Resistance, 500 ohms. Contact under 1,000 volts pressure for 25 seconds, at 5:25 P. M. Instant death without sound or struggle. Resistance after death, 200 ohms. Some time after death circuit again closed to ascertain whether muscles would still respond to action of current; muscles were made rigid during continuance of current, and relaxed as soon as circuit was opened. In each case the muscles of the subjects stiffened when circuit was closed; after about five seconds they gradually relaxed. Number of alternations, 288 to 300 per second. The experiments were under charge of Dr. Carlos F. MacDonald and others, representing the State, assisted by Dr. A. D. Rockwell, Dr. Edward Tatum, Mr. A. E. Kennelly and Mr. Harold P. Brown.

Testing the Detroit Storage Battery for Traction.

We are indebted to Mr. Frank B. Trout, the General Manager of the Woodward Electrical Company, of Detroit, for the following interesting account of tests made in that city.

"We made the first test in Detroit on March 13 with the car "Ampère," on the Highland Park Electric Road, with Mr. Frank B. Rae's motor and equipments and 84 cells of the "Detroit" storage battery. On the Highland Park road there are two cars running by the Fisher conduit system owned and controled by the Detroit Electrical Works. One of these cars, named the "Franklin," was put in the car house, and the storage battery car, "Ampère," was placed in service and made regular trips in place of the "Franklin." We started at the regular hour in the morning and made a full day's run, making 11 round trips with the storage battery car, carrying passengers in the regular way and making a speed of 11 miles per hour, when running a full day's run, 80 miles, with one charge of battery. The battery was fully charged the night before, and the last trip was made at the very same rate of speed as the first trip. As soon as it was dark, four 16 c. p. lamps were lit up from the same battery, and run to light the car until the car was put away for the day. Upon examination of our battery this morning we find that the voltage of each cell still remains two volts, and that there is enough current still in the battery to have made two or three trips more. The battery is in perfect condition, and the same may be said of the motor. A number of prominent citizens rode on this car and expressed themselves as perfectly satisfied that the Woodward Electrical Company, manufacturers of the Detroit storage battery, and the Detroit Electrical Works, manufacturers of Frank B. Rae's motor and equipments had solved the problem of street-car traction. We are satisfied beyond any doubt that

with this 300 ampère cell, which we use on this car, we shall be able to run regular trips of 100 miles with one charge. This makes the storage battery a practical success, as we can recharge this battery with 300 ampères in 6 hours for the next day's work, and even at a higher rate of charge if necessary.

"The Woodward Electrical Company are so well satisfied as to the durability and quality of the 'Detroit' storage battery that we guarantee the battery for 10 per cent per annum upon the full life of our patents, namely, 17 years. This should settle the question with street car men, as to whether it is profitable to use the storage battery."

Edison-Westinghouse Litigation.

A special dispatch from Pittsburgh, Pa., of March 14, says: In the United States Court to-day counsel for the Edison Electric Company asked ten days additional time for the taking of testimony in the case of the Westinghouse Electric Company against the McKeesport Company, an Edison concern. The thirty days additional time previously granted the Edison people expires one week from to day. The Westinghouse attorneys vigorously opposed a further extension. Edison's legal representative said that they were using every effort to have their testimony closed and were taking it in four cities. Judge Acheson finally granted three days extension, that is, until Saturday, March 23. There was great excitement in Westinghouse electric stock on the Pittsburgh Petroleum and Stock Exchange this afternoon, $54½ being bid at the last call. Eight months ago it was selling at $18 a share and had only advanced to $24 in November at the office of the company. The advance was said to be due to heavy buying from New York, Philadelphia and Boston, principally from the latter city. General Manager H. M. Byllesby says that there is absolutely no foundation for the report telegraphed from Boston today that the Westinghouse Company had sold its patent rights in Great Britain for $2,000,000 and would declare a stock dividend.

Tests of the Detroit Storage Battery.

BY DR. L. DUNCAN AND DR. G. A. LIEBIG, JR., JOHNS HOPKINS UNIVERSITY.

A few weeks ago there were sent to the Electric Testing Bureau of this University three types of cells as made by the Woodward Electric Company for the purpose of having such experiments conducted as would lead to the determination of the following quantities: First, capacity; second, internal resistance; third, durability; fourth, efficiency; the latter, as far as possible, in widely different conditions of charge and discharge. The three forms of cells were distinguished by the marks 25 M, 15 M, 11 P, respectively. The method pursued in the manufacture of these cells seems to be as follows: A block of appropriate size, consisting of a mixture of salt and lead, is cut into plates of the desired thickness, about ⅛ or ¼ inch. The plates are then immersed in water which dissolves out the salt, leaving the plate of lead with numerous pores of irregular shape throughout the entire mass. After this the pores are filled with a paste of oxide of lead in the ordinary way, following which is the process of "forming," and the plates are then ready for use.

I. *Capacity.* TYPE 25 M.

These cells are of twenty-three plates, eleven positive and twelve negative. The weight of the plates as joined up in the cell with lead connections was 84 lbs

Dec. 20 to 28. Charge, Table I.—Mean current 16 ampères; mean E. M. F. 2.35 volts; total charge 420 ampère hours. Discharge—Mean current, 17.5 ampères; mean E. M. F., 1.09 volts; capacity, 409 ampère hours; efficiency, 78 per cent.

January 8 to 14. Charge.—Mean current, 23.8 ampères; mean E. M. F., 2.27 volts; total charge, 453.6 ampère-hours. Discharge.—Mean current, 18 ampères; mean E. M. F., 2.5 volts; capacity, 378.2 ampère-hours; efficiency, 75 per cent.

TABLE I.—CELL 25 M.

Charge—Time.	Current.	E. M. F.	Amp. Hours.
2:45 A. M.	16	2	
5 P. M.	16	2.1	36
8:45 A. M.	16	2.2	
5 P. M.	16	2.4	132
8 A. M.	16	2.4	
5 P. M.	16	2.45	144
8:30 A. M.	18	2.55	
2:30 P. M.	18	2.5	108—420
Discharge.			
4 P. M.	19	2.1	
10 A. M.	19	2	342
10:50 A. M.	17	1.95	38
12:05 P. M.	17	1.85	
2:15 P. M.	12	1.7	23—403

Discharging all night.

January 17 to 22. Charge, Table II. and Fig. 2.—Mean current, 27 ampères; mean E. M. F., 2.25 volts; total charge, 431 6 ampère-hours. Discharge.—Mean current, 60 ampères; mean E. M. F., 1.78 volt; capacity, 352.4 ampère-hours; efficiency, 64 per cent.

TYPE 15 M.

The first charge of this cell was carried very much beyond the necessary limit, in order to reduce a considerable amount of sulphate which was found on the plate; weight, 67 lbs. 6 oz.

Dec. 4 to 8 Charge.—Mean current, 20 ampères; total charge, 390 ampère-hours. Discharge.—Mean current, 19.5 ampères; mean E. M. F., 2 5 volts; capacity, 170 ampère-hours; efficiency, 65 per cent.

TABLE II.—CELL 25 M.

Charge—Time.	Current.	E. M. F.	Amp. Hours.
12:15 P. M.	25	2	
2 P. M.	25	2.1	
4 P. M.	25	2.1	66.9
10:15 A. M.	30	2.15	
12 M.	28	2.22	
5 P. M.	29	2.25	199 5
11 A. M.	30	2.35	
2 P. M.	27.5	2.5	
5 P. M.	27.5	2.5	
5 P. M.	27.5	2.6	175.2—431.6
Discharge.			
10:40 A. M.	56	1.98	
3 P. M.	54	1.85	
4 P. M.	26	1.6	322.5
9:10 A. M.	58	1.95	
9:45 A. M.	38	1.60	29.9—352.4

Dec. 26 to 28. Charge, Table III.—Mean current, 18 ampères; mean E. M. F., 2.35 volts; total, 255 ampère-hours. Discharge.—

FIG. 5.

Mean current, 10 ampères; mean E. M. F., 2.8; capacity, 207.5 ampère hours; efficiency, 76 per cent.

Jan. 2 to 7. Charge.—Mean current, 18 ampères; mean E. M. F., 2.33 volts; total, 279 ampère-hours. Discharge.—Mean current, 40 ampères; mean E. M. F., 1.95; capacity, 157 ampère-hours.

TABLE III.—CELL 15 M.

Charge—Time.	Current.	E. M. F.	Amp. Hours.
9:30 A. M.	17	2.1	
2:15 P. M.	17	2.1	81
8:45 A. M.	17	2.2	
4:15 P. M.	19	2.3	142.25
8 A. M.	20	2.45	
10:30 A. M.	10	2.55	32. —255.25
Discharge:			
3:55 P. M.	10	2.1	
10 A. M.	10	1.98	100
10:30 A. M.	15	1.95	
12:30 P. M.	10	1.85	
2 P. M.	10	1.6	47.5—207.5

Discharging during the entire night.

Jan. 8 to 14. Charge, Table IV.—Mean current, 14 ampères; mean E. M. F., 2.35 volts; total charge, 238.8 ampère-hours. Discharge.—Mean current, 15 ampères; mean E. M. F., 2.6 volts; capacity, 216 ampère-hours; efficiency, 83 per cent.

Jan. 21. Charge.—Mean current, 25 ampères; mean E. M. F., 1.6 volt; total charge, 250.2 ampère-hours. Discharge.—Short circuit, mean current, 250 ampères; capacity, 83 ampère-hours. This cell was charged and discharged at very high rates, charging rates, 75 to 85 ampères; discharge rates, 250 ampères. This was done repeatedly.

TABLE IV.—CELL 15 M.

Charge—Time.	Current.	E. M. F.	Amp. Hours.
10:45 A. M.	13	2.15	78.6
2 P. M.	12.5	2.15	
5. P. M.	12	2.15	
10:15 A. M.	12.5	2.23	
3:30 P. M.	16.5	2.45	83.2
11 A. M.	16	2.45	
4. P. M.	15	2.55	77. —238.8
Discharge:			
9:40 A. M.	15	2.18	
2:15 P. M.	15	2	
4:20 P. M.	15	2	100
9 A. M.	15	2.15	
1:30 P. M.	14.5	2	
4 P. M.	13.8	2	102.6
9 P. M.	14	2.05	
10:30 P. M.	4	1	13.5—216.1

TYPE 11 P.

Weight of plate and connections 23 lbs., 5 oz.

Dec. 12 to 17. Charge, Table V.—Mean current, 84 ampères; mean E. M. F., 2.21 volts; total charge, 112.65 ampère-hours. Discharge.—Mean current 9.6 ampères; mean E. M. F., 1.95 volts; capacity, 95.9 ampère-hours; efficiency, 75 per cent.

TABLE V.—CELL 11 P.

Charge—Time.	Current.	E. M. F.	Amp. Hours.
9 A. M.	10	2.1	
5. P. M.	9.5	2.25	78
9 A. M.	6.6	2.35	
12 M.	9.5	2.5	28 65
12:40 P. M.	9	2.55	6—112.65
Discharge:			
11 A. M.	9.5	2.05	
2 P. M.	9.7	1.95	
4:20 P. M.	9.6	1.85	51.2
10:20 A. M.	10	2.05	
2:10 P. M.	9	1.95	
3:20 A. M.	7.3	1.6	44.7—95.9

The accompanying diagrams exhibit graphically the operation of the cells during the tests.

II. *Internal Resistance.* TYPE 25 M.—For mean current, .0036 ohm.

Type 15 M.—For mean current, .0064 ohm.

Type 11 P.—For mean current, .0085 ohm.

III. *Durability.*

As far as can be seen, the cells are in excellent condition, and no signs of deterioration are as yet evident. The cell 15 M, whose normal discharge rate is 20–25 ampères, was short circuited a number of times through about four feet of No. 8 copper wire, its resistance being about .0028 ohm. Fig. 5. The discharge rate in the cell was very high, being more than 250 ampères; the cell, however, seems to have suffered nothing by the treatment. The plates have not "buckled," nor have we found parts of the active material forced out from the pores.

IV. *Efficiency.*

The values of the efficiency vary with the rate of charge and discharge. For the normal rates of discharge the efficiency of the different type of cell examined is between 75 and 80 per cent. In some cases the values are low; this is due to the cell having been previously run down below the ordinary limit.

The Decision Against Edison in Canada.

Before the Deputy Commissioner of Patents. The Royal Electric Company, of Canada, petitioners, and Edison Electric Light Company, respondents. Messieurs Lash, Q. C., of Toronto; McGibbon, of Montreal; Curtis, of New York; and Kerr, of Pittsburgh, Pa., counsel for petitioners. Messieurs Hector Cameron, Q. C., of Toronto; MacMaster, Q. C., of Montreal; and Dyer, of New York, counsel for respondents.

This is a Petition to the Minister of Agriculture, bearing date May 1, 1888, to have declared null and void the patent No. 10,654, granted to Thomas Alva Edison, on Nov. 17, 1879, "for new and useful improvements on electric lamps, and in the method of manufacturing the same, the title whereof is *Edison Electric Lamp*," on the ground of violation of *The Patent Act*, Consolidated Statutes of Canada, Chap. 61, Sec. 37.* On Nov. 16, 1881, an extension of three months' time within which to manufacture was granted to the patentee, on his application to this effect, in which he alleged that "having been engaged in introducing his invention in other countries, he had failed in manufacturing in Canada, within the two years prescribed by law, owing to the large capital which is necessary to establish such manufacture."

By assignment the respondents became the holders of the patent.

The petition alleged that the patentee and his assignees had not manufactured the invention within the two years prescribed by law, and that the alleged extension of three months within which to do so had been obtained by false and wilful misrepresentation; that the patentee and his assignees had imported the invention into Canada after the twelve months allowed by law, and prayed, for these reasons, that the patent be declared null and void, and the extension above mentioned set aside and cancelled.

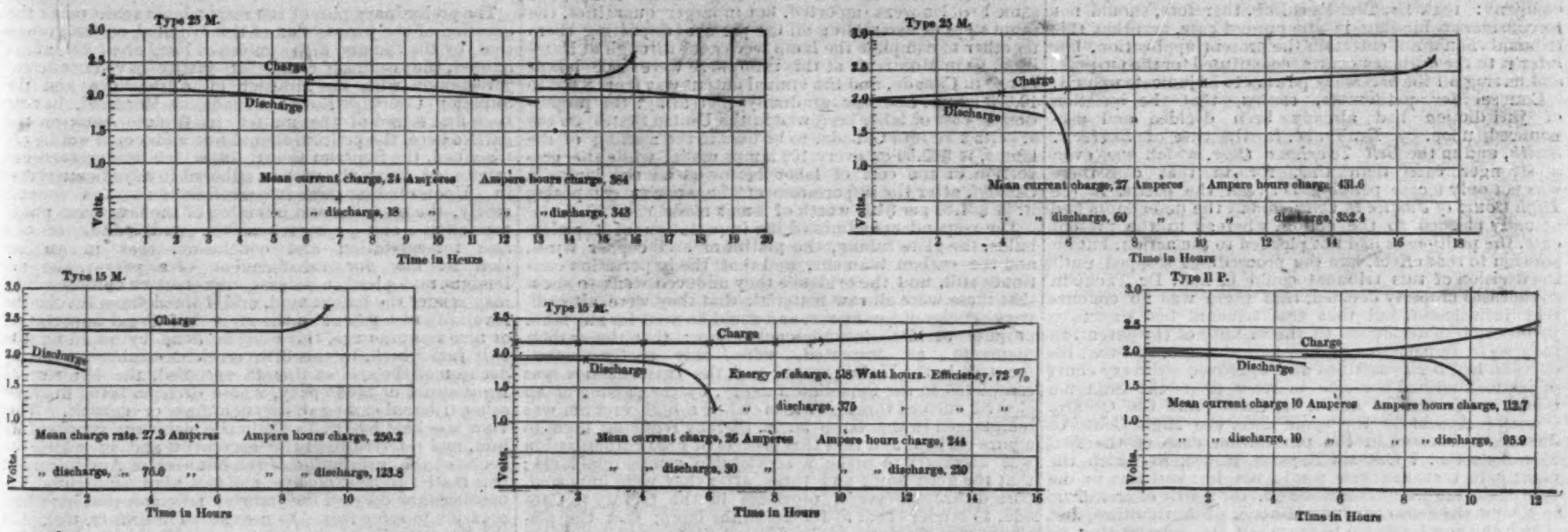
On the application of the petitioners, the Deputy Commissioner issued an order upon the respondents' counsel to produce at the trial all the invoices, accounts, letters and other documents, enumerated in a certain paper or "Notice to produce," previously served upon them, at the instance of the petitioners, in order that the same might be used as evidence if required.

By mutual consent, the trial was fixed for Nov. 13, when the respective counsel, with the witnesses being present, the case was proceeded with.

*SEC. 37.—Every patent granted, under this Act, shall be subject and be expressed to be subject to the condition that such patent and all the rights and privileges thereby granted shall cease and determine, and that the patent shall be null and void at the end of two years from the date thereof, unless the patentee or his legal representatives, within that period, commence, and, after such commencement, continuously carry on in Canada the construction or manufacture of the invention patented, in such manner that any person desiring to use it may obtain it, or cause it to be made for him, at a reasonable price, at some manufactory or establishment for making or constructing it in Canada,—and that such patent shall be void if, after the expiration of twelve months from the granting thereof, the patentee or his legal representatives or his assignee for the whole or a part of his interest in the patent, imports or causes to be imported into Canada, the invention for which the patent is granted; and if any dispute arises as to whether a patent has or has not become null and void under the provisions of this section, such dispute shall be decided by the Minister or the deputy of the Minister of Agriculture, whose decision in the matter shall be final.

2. Whenever a patentee has been unable to carry on the construction or manufacture of his invention within the two years hereinbefore mentioned, the commissioner may, at any time not more than three months before the expiration of that term, grant to the patentee an extension of the term of two years on his proving to the satisfaction of the commissioner that he was, for reasons beyond his control, prevented from complying with the above condition.

3. The commissioner may grant to the patentee, or to his legal representatives or assignee for the whole or any part of the patent, an extension for a further term not exceeding one year, beyond the twelve months limited by this section, during which he may import or cause to be imported into Canada the invention for which the patent is granted, if the patentee or his legal representatives, or assignee for the whole or any part of the patent, show cause satisfactory to the commissioner, to warrant the granting of such extension; but no extension shall be granted unless application is made to the commissioner at some time within three months before the expiring of the twelve months aforesaid, or of any extension thereof,



FIGS. 1, 2, 3, 4 AND 6.—TESTS OF THE "DETROIT" STORAGE BATTERY.

The respondents' counsel, in addition to the general denial, by way of preliminary plea, took exception to the jurisdiction of this tribunal, on the ground, that on March 31 last, and prior to the date of this petition, the respondents had taken action against the petitioners, in the Superior Court for Lower Canada, at Montreal, praying for damages, and the issue of an injunction, for infringement of the patent now in question; that the petitioners did not answer the action, but on May 18, applied for a stay of proceedings in the action, until the decision on this petition could be obtained, and which application the court had granted.

Counsel for the respondents argued, in effect, that the matters raised in the present petition could be urged as a defense to the action in the Superior Court, under the 33d section of *The Patent Act*, which is as follows: "The defendant in such action, may plead specially as matter of defense, any fact or default which by this Act, or by law, renders the patent void; and the court shall take cognizance of that special pleading and of the facts connected therewith and shall decide the case accordingly." That it is specially within the functions of a court of justice to determine the matters in issue herein, the court having power to compel the attendance of witnesses, the production of documents, to punish for contempt and for perjury, powers lacking in the Minister of Agriculture, and the Superior Court for Lower Canada, at Montreal, having been seized of this case, before the presentation of this petition, should not be, and could not be deprived of its jurisdiction; that it is contrary to the fundamental principles of justice and public policy that the Courts of Justice, in which the fullest investigation could be had, and the right of appeal preserved to both parties, should be ousted out of their jurisdiction, and the trial of the issue transferred to a semi-political tribunal, not having the power to compel the attendance of witnesses, or the production of papers, or punish for contempt or perjury, and from whose decision there is no appeal; that the jurisdiction of the ordinary courts is concurrent with that of the Minister of Agriculture, and it is a well established principle, that where there is concurrent jurisdiction, the court first seized of the case is allowed to adjudicate therein, and that the second court appealed to will not interfere; that Dr. Taché had ruled in the case of the *Telephone Manufacturing Company* v. *The Bell Telephone Company* that the ordinary courts had not concurrent jurisdiction in this matter, but in this he was in error, and moreover as this point did not arise in that case, there being no litigation before the courts with respect to it, his statement to this effect was mere *obiter dictum;* and his further statement, that the courts had sustained him in this view of the law, is equally erroneous—the decision in the case of *Smith* v. *Goldie* in the Supreme Court Reports, Vol. 9, p. 46, does not declare the jurisdiction of this tribunal exclusive, but merely conclusive—that is, where application is made to it in the first instance, and not as in the present case, where an ordinary court has already been and is seized of the case; that this is the view also taken by Justice Osler in the case of the *Bell Telephone Co. v. The Minister of Agriculture*, 7 Ontario Law Reports, p. 605, in which application was made for a writ of prohibition, to restrain the Minister of Agriculture from proceeding in a case then pending before him, on a petition to declare null and void a patent held by that company; that Dr. Taché's ruling, therefore, should not be considered binding in the present case, and that this tribunal should not entertain the present application, but refer it to the ordinary courts, constituted for the purpose, and having all the necessary powers to adjudicate upon it.

Counsel for petitioners, *contra*, that the question of jurisdiction had already been decided and pronounced upon, by Dr. Taché, in the case of *Barter v. Smith*, and in the *Bell Telephone Case*, which was even a stronger case than this, for in that case there was not only a case pending between the parties in the *High Court of Justice in Ontario*, but the defendants had actually pleaded to the action, whereas in the present case, the petitioners had not pleaded to the action, but on petition to that effect, had the proceedings stopped until the decision of this tribunal could be had; Dr. Taché in those cases properly decided, that there was no concurrent jurisdiction, but that this tribunal had exclusive jurisdiction to decide as to the validity of the patent, in the case of importation or non-manufacture, and that his decision had been sustained and approved by every court of justice that had occasion to refer to it—the Supreme Court, in the case of *Smith* vs. *Goldie*, and the Ontario Court of Appeal in the same case; the High Court of Justice in Ontario, in the prohibition case of the *Bell Telephone Co.*, 7 Ontario Reports, p. 605, in which the court held that the writ would not lie; and also in the case of the same *Bell Telephone Co.*, for a writ of *certiorari* to review the decision of the Minister of Agriculture, and which the court refused to grant, on the ground that no such writ would lie, and no review could be had, 9 Ontario Law Reports, p. 339; also the case of *Mitchell* vs. *The Hancock Inspirator Company*, tried before Dr. Taché, on reference from the Superior Court for Lower Canada, in which the judge granted a stay of proceedings, till the decision of the Minister of Agriculture could be had on the validity of the patent, under the 37th Section of *The Patent Act;* that all these decisions should be regarded as binding on this tribunal, and as settling the question of its exclusive jurisdiction in the present case.

The Deputy Commissioner stated, that in view of the large number of witnesses present from the United States, and other places distant from Ottawa, who were naturally anxious to return to their homes as soon as possible, he would not delay the proceedings at this stage, but would render his decision on this point, when judgment should be rendered on the merits of the case.

The evidence was then proceeded with, lasting over three days, including an admission of facts by the parties, when the case, by agreement, was postponed to the 17th December, for argument of Counsel, when the case was ably argued, at great length, by counsel on both sides.

The evidence adduced by the petitioners established in substance: That the patent was granted to Thomas A. Edison on the 17th November, 1879; that on the 16th November, 1881, an extension of three months time within which to manufacture was granted; that on the 12th February, 1880, Edison assigned the patent to "The Edison Electric Light Company," and on the 30th December, 1886, the latter assigned to "Edison Electric Light Company"—the respondents. The lamp consists of a glass globe or bulb, glass tubing, inside pieces of glass, platinum and copper wires, carbon filament and brass bottom; all these articles were imported from the United States, from the time the patentee and his assignees began to make the lamps in Canada, and still continue to be imported; that the process of making the lamp from these imported articles consisted of several operations, such as attaching the carbon filaments to the leading-in wires—the leading-in wires having been previously let into the glass and sealed in; the glass bulb and tube attached to it, the air exhausted from the bulb, and connection made with the brass cap or base to attach it to the socket, to connect with the circuit, supplying the electric current. On the 14th November, 1881, The *Edison Electric Light Company* started a small factory in Montreal, worked by two men, and the outfit consisted of a small dynamo, several pumps for producing the vacuum in the globes, several small glass blowers' fires, gas fires, altogether of the value of about $2,000, and commenced the manufacture of the lamps from the materials imported from the United States as above stated; and on the 17th had completed two lamps; the carbon filaments were put into the lamps in the condition they were brought in from the United States, and were not subjected to any further treatment or process of carbonization after their arrival in the factory in Montreal. The carbon filaments are made of bamboo, imported into the United States from Japan, in the crude or natural state, in strips, and on arrival at the factory in the United States, they are further split into smaller strips, the pith removed, and then by knives or dies, further reduced to the proper size of the filament; these filaments were then put on a block or mould packed with carbon, then put into a furnace and baked or carbonized; this process requires great skill and labor, and is very difficult, and can only be done by skilled workmen; they tried to carbonize the filaments in Montreal but could not succeed, as the men were not skilled in the work. The glass bulbs were made in the United States from pot glass, the glass blowers there blowing them by several processes into the size and shape required. These bulbs were made expressly for use on the incandescent lamps, and must have the same expansion as the platinum, and are not ordinary articles of commerce; the glass tubing also must be made from the same quality of pot glass as the bulbs, so as to have the same expansion; the platinum wire also was specially prepared in the United States for use in the lamps. The employés were instructed not to sell the lamps to any who did not use the Edison dynamos or plant, and they accordingly did not so sell them, and refused to sell to any not using the Edison plant; that it was the policy of the company to do this, as the sale of the plant was more profitable than the sale of the lamps, the proportion being that where 800 lights were installed the total price was $12,000, while the cost of the lamps at $1 each, was only $800, and this had practically the effect of creating a monopoly for the Edison plant. The first sale of lamps in Canada was made to the *Canada Cotton Co.*, at Montreal, in December, 1882. The capital stock of "*The Edison Electric Light Co.*," in November, 1881, was $720,000 or $780,000, the par value of the shares being $100, but they were then quoted and selling at from $1,000 to $1,200 per share, or a premium of $1,000 to $1,100 above par. In January, 1883, the factory in Montreal was closed, and the business transferred to Hamilton, and there increased and more men employed, but there was no change in the manner of getting out the lamps; the same articles were imported, but in larger quantities, the same steps of assembling all the parts and putting them together to complete the lamp were gone through at Hamilton, as in Montreal; at this time there were 3,800 lamps in use in Canada, and the annual output was from 8,000 to 10,000 lamps, and was gradually increasing; the proportionate cost of labor bestowed in the United States on the articles sent into Canada, to be used in the making of the lamps, is $32.50 on every 100 lamps made; while the proportion of the cost of labor bestowed on the lamps in Canada, after the importation of the articles composing it, is $21.80 per $100 worth of lamps made.

The respondents admitted the importation of the glass bulbs, the glass tubing, the platinum and copper wires, and the carbon filament, and that the importation continues still, and the evidence they adduced went to show that these were all raw material; that they were all ordinary articles of commerce, and could be used for any other purpose besides incandescent lamps; that the carbon filaments, as imported, were only partly manufactured in the United States, and the carbonization was completed in the Canadian factory, by the passing of an electric current through them while a high vacuum was maintained in the lamp bulbs, thereby reducing them to a pure carbon, and that this process of final carbonization was necessary to make a serviceable commercial lamp; that the glass bulbs and tubes, after they were imported, passed through several processes in the factory in Canada, to render them fit for use in the lamp; that the platinum was obtained in the United States, and before being sent into Canada for use in the lamps was re-melted from the crude material, and then drawn out into wire, and slightly alloyed with iridium, so as to make it a little harder; and the wire was attached to the carbon and fitted into the glass bulbs in Canada; that if the company had been compelled to manufacture the carbons in Canada, it would have ruined the business in Canada; that the platinum wire would have cost two hundred fold more in Canada, as it requires a special furnace to prepare it; that the cost of material in the United States, as imported into Canada, would be in the proportion of one-third, and the labor in Canada, two thirds.

Counsel for the petitioners argued that the evidence clearly showed that the patentee and his assignees had not complied with the provisions of *The Patent Act;* that they did not commence or carry on in Canada the manufacture of the invention within the time prescribed by law, and that they had imported it after the time allowed by law, and in addition thereto had refused to sell the invention as they were bound by law to do; that they showed bad faith and no intention to comply with the law from the beginning, as they only started their factory and began making the lamps on the 14th November, 1881, a few days only before the limit prescribed by *The Patent Act;* then again it is proved that at this period, when they applied for and obtained an extension of time, within which to manufacture, on the ground or pretension of the large capital necessary to carry on the manufacture, the capital stock of the Edison Electric Light Company, the then holders of the patent, amounted to over $700,000, the par value of the shares being $100, and their market or selling price was quoted in the newspapers at $1,000 or $1,200, or a premium of from $1,000 to $1,100 above par, while it proved that the whole capital or plant they had in Canada at this time was only $2,000; this showed their utter want of good faith, and the misrepresentation amounting to fraud, practiced upon the Minister of Agriculture, to obtain an extension of time; that they refused to sell their lamps unless in connection with their own plant, thus creating a monopoly for their dynamos or plant, which they had no right to do by law, which does not authorize or justify the imposing of conditions or restrictions upon the purchaser, as to the use of the invention when purchased by him; that the subsequent process of carbonizing the filament, after it was put into the globe and subjected to the passage of an electric current while a high vacuum was maintained, was no part of the patent, and could not be claimed for it; that the labor expended in the United States upon the articles before they were imported into Canada amounted, on the 66,500 lamps proved to have been made up to the present time, according to the proportions of cost proved, would amount to $30,000, which was so much loss to the Canadian laborer; and the manufacture of those lamps was increasing from year to year.

For the respondents it was contended that the patentee and his assignees had in every respect complied with the terms of *The Patent Act;* that they had commenced the manufacture within the time prescribed by the act, and had only imported the component parts of the lamp in the raw state or as raw material and ordinary articles of commerce; that there was no absolute proof that they had refused to sell except in connection with the Edison plant, and even if this were proved, it was no violation of the act, as the law did not, and could not, reasonably be construed to compel them to sell their lamps to opposition companies, who would run them on the arc or other plant not suited to the Edison incandescent lamp, and thereby injure or destroy the reputation of the lamp; they were always willing and ready to sell to those who would do justice to the lamp, and act fairly and honestly in giving it a fair trial; with regard to importation, it is proved that the glass globes and carbon filaments could not be made in Canada, and even if they could be made it would be at such a ruinous cost and expense that the business of manufacturing the lamps in Canada would have to be abandoned; that the law did not contemplate any such unreasonable and unjust condition as this; that in any case the importation of these articles was a small matter in comparison with the cost of labor expended on the manufacture of the lamps in Canada; that, moreover, they were merely ordinary articles of commerce, and not the invention or subject of the patent; that in two cases recently decided in the Supreme Court, and not yet reported, the *Ayer* case and the *Grinnell* case, in which the defendants were sued under the *Customs Act*, on the ground that they imported certain ingredients or articles, and afterwards assembled or put them together and manufactured an article upon which a higher duty was payable, the Custom authorities claiming that they were liable for the higher duty, the Supreme Court decided that the articles or ingredients were what they were when they crossed the boundary line, and were not liable for the higher duty on the article into which they were manufactured after their entry into Canada; that the imported articles in the present case, could not be held to be the invention patented, and the patent could not, therefore, be declared void for contravention of *The Patent Act.*

The preliminary plea of the respondents again raises the question of the jurisdiction of this tribunal, on the ground that, by the 33d and 37th sections of *The Patent Act*, above quoted, the ordinary courts of justice have concurrent jurisdiction with the Minister of Agriculture and the Superior Court for Lower Canada, at Montreal, having been first seized of the matter in dispute between the parties here, the petition should not and could not be entertained, the Superior Court, in which the proceedings originated, being the proper tribunal to adjudicate therein. Upon reading these two sections of the Act concurrently, the meaning and intention of the law seem plain, consistent and comprehensible, and admit of the sole interpretation and conclusion, that in an action at law for infringement of a patent, the defendant may plead in defense, any fact or default which may render the patent void, and if the defense invoke the invalidity of a patent on the ground of illegal importation or non-manufacture, this must be done by pleading the only fact which, by the 37th section, establishes it—the decision of the arbiter therein specified, the Minister of Agriculture or his Deputy, whose decision being final, no other tribunal can establish such fact or default. This view was held by Dr. Taché in the decisions rendered by him, and referred to at the argument, and in which he declared the jurisdiction of the Minister of Agriculture in this matter to be exclusive, and this view or finding has been sustained by all the judicial tribunals that have had occasion to refer to it. In the case of *Smith vs. Goldie* in the *Supreme Court*, the summary at the head of the report, if not to be considered as of the substance and part of the report, must assuredly be accepted as a correct and accurate interpretation thereof, contains the following words in paragraph 3: "The Minister of Agriculture or his Deputy, has exclusive jurisdiction over questions of forfeiture under the 28th (now 37th) section of *The Patent Act;*" and Henry, J. in rendering judgment in the case, upon referring to Dr. Taché's decision in *Barter vs. Smith* says: "Having well considered the case as presented before him, I would have come to the same conclusion as he did. I think the law as laid down and explained by him, in his exhaustive, and, I will add, able judgment, cannot properly be questioned. I fully concur in his conclusions, as I do also in his reasons." Again, by the Superior Court at Montreal, as reported in the *Mitchell* and *Hancock Inspirator Company* case, p. 2, where proceedings had been instituted for infringement of the patent in that court, and the special pleading was met by the demurrer to the effect that the nullity caused by violation of the 28th (now 37th) section of *The Patent Act*, cannot be tried by any other court than that of the Minister of Agriculture, upon which a stay of proceedings was asked for and granted, in order to obtain the decision of this tribunal. Again, in this present case, the Superior Court, at Montreal, has granted a stay of proceedings until the decision of this tribunal shall have been obtained on the question at issue.

I, therefore, hold that the Minister of Agriculture, or his deputy, has exclusive jurisdiction as to the question of the validty of the patent under the 37th section of *The Patent Act*, and cannot divest himself of it by relegating it to any other tribunal whatever.

Having thus disposed of the preliminary plea, I will now consider the case on its merits.

The first consideration which presents itself is, to ascertain the nature of the invention claimed by the patent, the claims of which are:

First. "An electric lamp for giving light by incandescence, consisting of a filament of carbon of high resistance made as described, and secured to metallic wires as set forth."

Second. "The combination of carbon filaments within a receiver made entirely of glass through which the leading wires pass, and from which receiver the air is exhausted for the purpose set forth."

Third. "A coiled carbon filament or strip arranged in such a manner that only a portion of the surface of such carbon conductor shall radiate light as set forth."

Fourth. "The method herein described of securing the platina contact wires to the carbon filament and carbonizing of the whole in a closed chamber, substantially as set forth."

It is manifestly clear that the essential feature or element of the invention, as particularly described in the first and second claims is—*a carbon filament of high resistance*, this is the novelty which the inventor has contributed to the art of incandescent lighting, and it cannot be disputed by any one having the slightest acquaintance with patent law, that the carbon filament as imported by the patentee and his representatives, the respondents, and which they still continue to import, is claimed in and covered by the patent, or that any one who should use it, without the permission or consent of the respondents, would render himself liable to them in action for infringement of the patent.

The process of further carbonizing the filament after it is introduced into the bulb, by passing an electric current through it while a high vacuum is maintained, as described by some of the witnesses for the respondents, as well as by Mr. Edison himself, is not anywhere described or claimed in the patent, and forms no part of it; on the contrary, it is the subject of another patent, obtained subsequently, by the same inventor, Mr. Edison, on the 5th July, 1881, under the number 13,057, the fourth and fifth claims of which are as follows:

Fourth. "The method of treating carbon conductors for electric lamps, consisting in enclosing the conductor in a glass case or globe, exhausting the air therefrom, heating the conductor by an electric current, and then hermetically sealing the glass case or globe."

Fifth. "The method of treating carbon conductors for electric lamps, consisting in enclosing the conductor in a glass globe, exhausting the air therefrom, heating the conductor by an electric current to a higher degree than that at which it is intended to ordinarily raise the conductor in use, and then hermetically sealing the glass case or globe."

Here, then, the process is fully and explicitly described and claimed, and the use or employment of it cannot be invoked or relied on by the respondents to sustain the patent now in controversy.

The next feature of importance, after the method of securing the platina contact wires to the carbon filament, as set forth in the *fourth* claim of the patent in contestation, is the glass globe or bulb referred to in the *third* claim, and it is abundantly proved and admitted by the respondents that they have always, and still continue to import these, and have never manufactured them in Canada.

Some of the witnesses for the respondents state that the carbon filaments and the glass bulbs are exceedingly difficult to manufacture, requiring great skill and judgment, and that they cannot be made in Canada, and that there is only one factory in the United States where they can be made to the satisfaction of the respondents, but this seems irreconcilable with the statement of these same witnesses in calling these articles raw material. Mr. Edison himself, in his affidavit, referring to the glass bulbs, says: "They are strictly of the character of raw material," and in view of the fact also that the records of the Patent Office show that on Nov. 23, 1892, Mr. Edison obtained a patent for the process of manufacturing glass bulbs for incandescent lamps from pot glass. The allegation of inability to manufacture in Canada is no plea in defense of a Canadian patent, and it would be a singular misconception of the spirit of the law if a patentee, probably holding a patent for his invention in the United States, or other foreign country, should suppose he could hold to his Canadian patent, declare his inability to manufacture it in Canada, ignore the fact he was thereby preventing any one else from engaging in the industry, and defeating the very object and intention of *The Patent Act*, enacted to encourage and protect home labor and manufacture.

The bamboo cane was, and continues to be, imported from Japan into the United States, by the respondents, in its natural state, and was there, by a series of manipulations or processes, reduced to a filament of required size and proportion, and was then further subjected to the very difficult and delicate process of carbonization, and in this state was imported into Canada expressly for use in the lamps.

The platinum, another component part of the invention, was, and still is, imported into the United States from Russia, by the respondents, and was there melted and alloyed with iridium, drawn into wire, and otherwise specially prepared, and then imported into Canada for use in the lamps.

I find that every essential feature, element and component part of the invention was, and still continues to be, imported into Canada by the respondents, in a manufactured state, for the especial purpose of assembling or putting them together, so as to make them an incandescent electric lamp, such as that described and claimed in the patent held by them, and now in dispute.

The two cases of *Ayer* and *Grinnell* in the *Supreme Court*, referred to at the argument, but not yet reported, do not apply to the present case, as those two suits were brought under the *Customs Act*, in virtue of which the defendants had a perfect right to import the articles separately, and if afterwards, by compounding or combining these together, they manufactured an article or commodity, of greater commercial value, subject to a higher tariff duty, they contravened no section of the *Customs Act* giving them the exclusive right to manufacture, on condition that they should not import, such as that in *The Patent Act*, which gives the inventor the exclusive right to manufacture his invention, on condition that he shall not import it; there is, therefore, no analogy between those two cases and the one now under consideration.

I therefore hold that the patentee and his representatives have imported into Canada since Nov. 17, 1880, and still continue to import, the various elements and parts comprising the invention claimed in the patent No. 10,654, in a manufactured state, and that they have not at any time since the date thereof manufactured the invention in Canada.

In view of the above, I do not consider it necessary to do more than refer to the other point raised in the case—that of refusal to sell, and even if I had to pronounce upon this point, it is more than probable I would entertain a view adverse to that ably contended for by the respondents.

Considering that the Commissioner of Patents is presumably the parent and natural protector of patents, and should extend a liberal interpretation to matters urged in their defense, consistently with a just appreciation of public interests, and in view of the importance of this case, and the large interests involved, I have bestowed upon it all the care, study and consideration which my time and ability permitted, in the endeavor to arrive at a sound, just and equitable conclusion.

I accordingly decide that the Patent granted to Thomas Alva Edison, on the 17th November, 1879, under the number 10,654, for the *Edison Electric Lamp* has become null and void, under the provisions of the 37th section of *The Patent Act*.

R. POPE,
Deputy Commissioner of Patents.

Department of Agriculture,
Patent Office,
Ottawa, 26th February, 1889.

Special Correspondence.

NEW YORK NOTES.

OFFICE OF THE ELECTRICAL WORLD,
103-177 POTTER BUILDING, NEW YORK, March 18, 1889.

The New York Electric Club listened on March 14 to a very interesting lecture by Prof. Robert Spice, Professor of Chemistry, at the Cooper Institute, upon "Light and Color." There was a large attendance. The annual election of the club will be held on Thursday evening, April 18, and a meeting for nominating officers will take place on March 21.

Prof. E. L. Nichols, of Cornell University, read an admirable paper on March 12, at the College of the City of New York, before the American Institute of Electrical Engineers, on "The Efficiency of Methods of Artificial Illumination." There was a large attendance, and the paper, which was freely illustrated by means of the lantern, was followed by a discussion.

The Edison Illuminating Company, of Brooklyn, through their manager, Mr. Field, have just awarded one of the largest steam-engine contracts ever placed in New York, it being for twelve Ball automatic compound engines of 250 h. p. to Charles R. Vincent & Co., of No. 15 Cortlandt street. These engines will be placed in the new central Edison station in Brooklyn, and will mark the latest development in high speed steam engineering, it being Mr. Field's intention to make this plant a model one in every respect.

The Newark Watch Case Material Company, of 19 Ward street, Newark, report an extremely active demand for their new magnetic watch shield, which seems to have struck the popular fancy, orders coming in from electrical people from all parts of the globe, especially from the Union and Canada. The case is not only a protection against magnetism, but against wear and tear. It is lined with velvet, which keeps the watch bright and clean and free from the scratchings which so often disfigure a fine piece of chasing and engraving.

New York City Lighting.—The Gas Commission has approved the new form of contracts for lighting the streets during the year beginning May 1, and has ordered its clerk to advertise for proposals for gas and electricity. These contracts contain a clause which prevents the acceptance of the bid of any electric light company which does not possess the necessary plant, either in form of wires strung on poles or laid in subways. This is to prevent the erection of new poles and the stringing of new wires. The Mayor says that if the electric light companies did not bid low enough the city would be lighted by gas, since there was only just so much money appropriated for lighting, and no more could be spent. The Corporation Counsel has sent an opinion to the commission to the effect that the city could safely pay all the money it owed to electric light companies, notwithstanding suits against the city by other companies.

Automatic Fire Alarms.—My attention was recently called to the fact that the New York Board of Fire Underwriters had passed some important resolutions at a meeting held in February, 1888, with regard to automatic fire alarms. These resolutions provided that in future no allowance will be made for new equipments of automatic fire alarms where the thermostat was not constantly in circuit, and that the allowance theretofore granted for open circuit systems, as well as systems where the thermostat was attached to the wires other than permanently, would be discontinued on and after a certain date. At a subsequent meeting it was decided to make that date June 1 next. This seemed to me a significant step, and I took the first opportunity that offered to call upon Mr. W. DeL. Boughton, Chairman of Committee on Police and the Origin of Fires of the Board, at his offices, 44 Pine street, and get his views on this subject. I wanted to know what was the meaning of the action. Mr. Boughton told me that there was one automatic fire alarm company in this city that had felt aggrieved at the passage of such a resolution by the Board. They claimed that it did them an injustice, their system meeting the requirements in the main; but still the Board did not see it in that light, and had passed these resolutions to protect themselves and the interests they represent against all possible accidents. They believed that the closed circuit system met all the requirements of the case; at any rate, they considered themselves competent to judge; it was not their object to antagonize any existing company, but they had assured themselves of the perfect operation of the closed circuit system, and they were going to give it the chance of a thoroughly fair test. If it failed they were responsible for their action in the matter, and if after a year or more they found that false alarms or other extraneous disturbances were on the increase, then they would like to make a still further change in the system used, but they did not anticipate any such difficulty.

Incandescent Lighting in Brooklyn.—Having received many invitations to call at the offices of the Brooklyn Incandescent Light Company, 195 Montague street (the Mercantile Library), I took occasion last week to drop into their beautiful new offices, and was much pleased with what I saw. They occupy a part of the main floor of the handsome library building on the left of the entrance, and have fitted it up in old oak with furniture to match. The opportunity has been seized to make an effective display of incandescent lighting. Each of the half-dozen oak desks has a very pretty drop light, and overhead in the centre are beautiful combination fixtures, one of which, especially attractive, was made by Oxley, Giddings & Enos. The commercial and private offices are all fitted out in a similar manner. The officers of the company are T. E. Otis, president; Richard Arnold, vice-president; C. T. Carritt, treasurer, and E. T. Trecartin, secretary. Mr. Arnold escorted me several doors below the offices to the basement of a large building where they have set up 992 cells of the new type of storage battery invented by Mr. E. R. Knowles. In this station current is, so to speak, kept in stock for the supply of the offices above, and the surrounding buildings and residences. They are already feeding daily nearly 1,000 lights, and will furnish 1,600 from this station, which is equipped with much neatness and ingenuity. They are furnishing a large number of estimates for lighting churches, bathhouses, stores, meeting rooms, etc., in the vicinity, and a large number of these estimates have been accepted with alacrity. This station is supplied with current from the old original plant of the Citizens' Electric Company, some blocks away, and eight more stations are being fitted up in a similar manner in the business and thicky-settled residential portions of the city. Each of these plants is placed in an inexpensive cellar or basement, and, together, they will furnish current for thousands of lamps. The total capacity of the generating station, when it is thoroughly overhauled and equipped, will be 15,000 lights. Each of these sub-stations will be fitted up, as is the case at Montague street, with the new system of switch-boards for charging and discharging, devised by Mr. Knowles, handling the batteries in groups of 32 cells each, and enabling the person in charge to throw the battery in series or multiple arc in any desired combination. The Mutual Electric Light Manufacturing Company, which controls the Knowles apparatus and system, has offices with the Brooklyn Company and is now completing a new generator for charging, which will be put in the down-town station on Liberty street. Another concern, under practically the same management, is the Electric Wiring and Construction Company of Brooklyn, T. E. Otis, president; Richard Arnold, vice-president; C. T. Carritt, secretary and treasurer, and W. A. Belcher, general manager. This company, up to March 11, have installed 2,500 lamps, and already have contracts on hand for a thousand more. They have a force of twenty men, and will soon have to increase it. Mr. Knowles has the general supervision of all the work, and has an excellent superintendent in Mr. T. J. Fay. It will be seen from this that so far as incandescent lighting is concerned Brooklyn is waking up very quickly.

W. T. H.

NEW ENGLAND NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
Room 8, Cook Building, cor. Franklin and Congress Sts.
BOSTON, March 18, 1889.

Mr. Geo. T. Manson, of the Okonite Wire Company, New York, was in this city last week.

Removal of Offices.—The New England branch offices of the "C. & C." Electric Motor Company have been removed from No. 19 Pearl street to No. 32 Oliver street, Boston.

Mr. C. F. West, formerly superintendent of telegraph of the Mexican Central Railway Company, is now identified with the Westinghouse Electric Company as salesman in the States of New Hampshire and Vermont.

A Boston Board of Electrical Control.—The Citizens' Association, of Boston, presented a petition to the Massachusetts Legislature on Wednesday, March 13, requesting the establishment of a board of commissioners of electrical subways.

Eddy Electric Motors.—Messrs. Spaulding & Buck, Boston, the New England agents of the Eddy motors, and of the new speed indicator manufactured by the Eddy Electric Manufacturing Company, are making rapid headway in their sales, and meeting with encouraging success. This firm has just filled an order for Holtzer & Cabot, which represents a 3 h. p. Eddy motor, and several speed indicators.

Bituminous Coal.—It is a matter of great interest, as well as of vital importance, to every one identified with electric light enterprises, to know where to purchase coal that is not only specially adapted for use in electric light stations, but low in price as well. The Irvona Coal Company, through its New York and New England agents, Messrs. F. R. Chapman & Co., No. 71 Kilby street, Boston, is offering great inducements to the electric light people to give the "Irvona" coal a trial.

New Bernstein Factory.—The Bernstein Electric Company's new factory in South Boston is not only finished, but the machinery and appurtenances requisite for conducting a first-class manufacturing business is about all in position, and almost ready to start up. Within a fortnight this company will begin to fill the numerous orders for its popular series incandescent lamps that have accumulated during the unavoidable interruption to business caused by removal from the old factory to the new.

Mr. Wm. A. Carey has been associated with several electrical enterprises in this section for some five years, and during the past twelve months an active and able assistant to General Manager P. H. Alexander, of the Sawyer-Man Electric Company. Mr. Carey's numerous friends will be pleased to learn that he has been promoted to the important position of district agent for the Sawyer-Man Electric Company for New England, and general district agent for the territory east and northeast of the Connecticut River for the Westinghouse Electric Company.

Sprague Stationary Motors.—Messrs. Sawyer & Blake, Boston, the New England agents of the Sprague Electric Railway and Motor Company, have been enjoying a great rush of orders for stationary motors since the opening of the present year. Among the Boston orders filled recently are the following: Mariner & Co.'s machine shop, 5 h. p.; Shawmut National Bank, ½ h. p.; Simonds & Co., printers, 5 h. p.; Elmer Chickering, ½ h. p.; Albert Hallett, printer, 2 h. p.; Burrill & Son, machinery, 3 h. p.; Chas. W. Bascom, printer, 1 h. p.; John Tein, lathes, 3 h. p.; and John Becker, machinery, 5 h. p.

Mr. C. Whitney, president of the Westborough Electric Light and Power Company, died at his residence, Westborough, Mass., on March 2. Mr. Whitney was a man who took great interest in electric matters, and the blow will be a severe one to the electric company, and also the town in which he resided, he being a very public spirited man. Mr. Whitney was one of the early people to enter into the electric lighting business, and it was through his instrumentality that the Westborough Electric Light and Power Company was formed, and the success of the company has been largely due to his efforts. Being a man of large wealth and influence, he threw it into this enterprise whenever occasion required.

Woodward Underground System.—Tuesday afternoon, March 12, a very interesting exhibition of the improved underground or conduit system of the Woodward Underground Telephone and Telegraph Company was given in Dedham, Mass., in the presence of a large number of electric light and telephone people. Some three or four months ago the County Commissioners of Norfolk County gave the company an opportunity of practically demonstrating its system by connecting the court-house and jail in Dedham by

its underground wires. The system as laid consists of a wooden conduit 2½ by 3 inches, filled with a patented composition, imbedded in which are three wire cables, about half an inch apart. These cables supply 220 incandescent lamps in the court-house and jail, beside furnishing telephone and telegraphic communication between the two points, and also working electric signal bells and the regulation fire alarm. The exhibition yesterday demonstrated that there was no interference of one wire with another, but that the telephone communication was singularly clear and distinct, with not the slightest buzzing sound that is thought to be almost inseparable from the juxtaposition of telephone and electric light wires.

The History of an Old Firm.—The firm of Fuller, Holtzer & Co. having been dissolved Dec. 31, 1888, Charles E. Fuller and Frank Fuller, members of the late firm, continue in the electrical business at the old stand, 27 Arch street. Beside handling their former line of goods, the new firm will place before their customers a new line of electrical goods, including annunciators and electrical bells, all of new designs. The handling of insulators, brackets and similar goods at wholesale rates will form a new department in this house. With improving health, Mr. Charles E. Fuller will soon place the selling business of the firm far in advance of its former position, and upon an entirely new basis, now having his hands free to accomplish this result. Mr. Frank Fuller, as heretofore, assumes entire charge of the business of the firm relating to the outfitting of houses, hotels and buildings of all kinds with annunciators, electric bells, etc., etc. This branch of the business now employs the largest number of workmen within the history of the house, and under existing arrangements will necessitate an increase of the force of experienced electricians and mechanics. The history of the Fuller family in the "Bell Whacking" business is familiar to nearly every one of your readers, having been first established in the year 1809, by Seth Fuller, the grandfather of the two members of the present new firm. After Seth Fuller, his son, Seth W. Fuller, continued the business to within a few years ago after a long and very active business life. He in his time equipped a very large number of hotels in almost every State in the Union and was the pioneer in the electrical annunciator and bell business in the United States. He was followed by his sons Charles E. and Frank, who continued the business under the father's name. They, after a brief partnership, with others have again formed this co-partnership, and continue under the old name, Seth W. Fuller, and at the old location.

W. I. B.

PHILADELPHIA NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
31 City Trust Building, Philadelphia, Pa., March 18, 1889.

Illuminating the City Fathers.—Both branches of city councils have agreed to introduce electric lights in the Chambers, which are are now lighted by gas. The Westinghouse alternating system will probably be used.

To Close Out the Partz Company.—The sheriff of this county has advertised to sell out the effects of the Partz Battery Company on Monday the 18th inst. It is probable that a new company will be formed after the affairs of the defunct organization are wound up, and will continue the business.

A Question of Earnings.—The ordinance lately presented to city councils authorizing the Frankford Avenue Electric Light Co. to lay wires, was buffeted about the chamber on Thursday last, owing to a doubt that the city could tax the company 6 per cent. of their net earnings, a provision insisted upon by some members and incorporated in the ordinance. As no agreement could be reached, the bill was considered indefinite in its limitations and was returned to the company for improvement.

Two Interesting Discourses.—President M. D. Law, of the Philadelphia Electrical Society, lectured before that body on Saturday evening, the 9th inst., on "Construction and Use of Dynamos." He held the attention of his audience for over two hours, and at the conclusion a resolution of thanks was unanimously tendered Mr. Law for his instructive address. Last Saturday evening was given to Mr. J. C. Sager, assistant to Chief D. R. Walker, of the Electrical Bureau, who spoke on "Fire Alarm Telegraphs." Mr. Sager's long experience with this branch of the service was instrumental in bringing out some new and interesting features connected with it, and his lecture was highly enjoyed by those present.

A Famous Bird.—Not long since I mentioned in this column the case of a parrot which had ostensibly been restored to an animated existence by the application of the electric current. Later information confirms the report and states that Mr. Samuel H. Black, of New Castle, Del., is the owner of the bird and the originator of this brilliant idea of anticipating the resurrection. The parrot, which was apparently lifeless, was no doubt enabled to eat, drink, sleep and so on, by the treatment, but its power of speech is wanting. The question arises whether the current deprived the parrot of the use of its memory or paralyzed its vocal organs, or whether the failing is due to a disinclination to reveal any secrets of the "bourne." In either case, Mr. Black is hopeful that the reticence is only temporary, and he is endeavoring to teach the bird certain phrases that it was familiar with before the "transition and restoration" occurred.

The Thomson-Houston Electric Company have done some most excellent work in this city, and their list of customers is constantly increasing. On Market street, where most of the large business houses are located, they have installed the following plants, dynamos, engines, and all the accessories: Simons & Co., 50 arcs; Young, Smyth, Field & Co., 60 arcs; Wood, Brown & Co., 60 arcs; Granville B. Haines & Co., 50 arcs; Hood, Bonbright & Co., 150 arcs; Snellenburg & Co., 70 arcs; Hirsch & Bro., 50 arcs; Adams Express Company, 70 arcs. They are now installing for the Camden (N. J.) Electric Light Company an increase of 100 arcs, and 1,500 incandescent lights, alternating current. Some of their recent contracts are: Langhorne, Pa., Electric Light Company, 500 incandescent lights, alternating system; Lewistown, Pa., Electric Light Company, 600 incandescent lights, alternating system; Cumberland & Pennsylvania Railroad at Mt. Savage, Md., 100 incandescent lights, direct system; Pottstown, Pa., Light, Heat and Power Company, 50 arc lights; Harrisburg, Pa., Electric Light Company, 100 arcs, additional order. A Thomson-Houston plant of 20 arcs has just been put in the clothing store of James Wilde & Co., Tenth and Chestnut streets, this city.

The Telephone in Philadelphia.—The Bell Telephone Company has, I hear, awarded the contract for the erection of a permanent central office at Nos. 406 and 408 Market street. The new building will be a handsome affair and in keeping with the many massive structures that have reared their heads in the business section in the past few years. The company will spend $75,000 for a switch-board in the new building. In a month or less it will continue work on the subway on Market street which is designed to hold all the wires that are now overhead on that and adjacent streets. The subway extends from Front to Eleventh street, and will be continued out Market street to the Schuylkill River. It will make a detour around the City Hall via Thirteenth, Arch and Fifteenth streets. Most of the work will probably be completed within the present year. The idea is to have small conduits extending from Market street on every alternate street, so that all overhead wires may be carried through them to a tall pole in the centre of a block and then distributed to the buildings within the block. This work is designed to bury all the wires between the two rivers and Vine and South streets, and will entail a cost of $1,000,000. The Western Union Company's wires will also be carried in the same subway and conduits.

The Taylor Manufacturing Company, of Chambersburg Pa., report trade as fairly active, and the following among recent installations and sales of "Beck" automatic engines, and complete steam plants for electrical service: One 13 by 15 inch engine for the Thomson-Houston Electric Company, of Natchez, Miss.; one 12½ by 15 inch engine and two 60 and 70 h. p. boilers, all complete, to the Danville Street Car Company, of Danville, Va., for operating their Thomson-Houston Electrical Street Railway in place of their former water-power service; a second engine, size 7 by 8 inch cylinder, to the Grace Hospital of Detroit, Mich.; one 15 by 18 inch engine for the Georgia Electric Light Company, of Atlanta, Ga., for operating their electrical steeet railway of the Thomson-Houston system; one 13½ by 15 inch engine to the Fort Wayne, Ind., Jenney Electric Light Company; one 10½ by 12 inch engine and 56 inch by 16 foot boiler, complete, to the Lewistown, Pa., Electric Light, Heating and Power Company; one 9½ by 12 inch engine for the United States Trust Company, through their New York branch office, Cooke & Co., Managers; one 7 by 8 inch engine for the Reyman Brewing Company, of Wheeling, W. Va.; one 10½ by 12 inch engine and 60 inch by 14 foot boiler, complete, to the Winchester Gas Company, Winchester, Va.; one 9 by 9 inch vertical automatic engine and boiler, arranged on the same base, to the Cumberland Valley Railroad Company, for operating the dynamos in their electric light car; one 13½ by 15 inch engine and 66 inch by 16 foot boiler, complete, for the Baton Rouge, La., Electric Light and Power Company; one 11½ by 15 inch engine for the Shreveport, La., Gas Company. They have also sold, through their Chicago, Ill., office, one 12½ by 15 inch automatic engine, to operate a train of rolls, and a 20 by 26 inch engine, to operate a train of rolls, the latter engine being the first of that size they have built.

E. F. C.

WESTERN NOTES

BRANCH OFFICE OF THE ELECTRICAL WORLD,
44 Lakeside Building, Chicago, March 16, 1889.

An Electric Fire Alarm in Cadillac, Mich.—An electric fire alarm system, consisting of eight signal boxes, has been installed in the city of Cadillac, at the cost of $1,975.

Omaha Electric Railroad Increase.—The Omaha & Council Bluffs Railroad and Bridge Company, using the Thomson-Houston system, have contracted to extend their plant by the addition of two new cars.

A Westinghouse Plant for Grand Rapids.—The Grand Rapids Electric Light and Power Company closed a contract with the Westinghouse Electric Company, recently for a plant of 2,500 incandescent lights of the alternating system.

Conduits in Milwaukee.—The Milwaukee Telegraph Company, which began operations several years ago, by putting part of its wires underground, is about to lay underground conduits under one of the principal streets, permission having been given by the Board of Public Works.

An Exhibit on the Way to Paris.—The Sperry Electric Company of Chicago have recently shipped their exhibit to Paris for the exposition. This will consist of a complete lighting station with all the improved apparatus of the company. The same company have also contracted for a 20-arc light of their improved high tension pattern to go to Ottumwa, Iowa. This makes a total of 80 arc lights there.

Electric Light for Sandusky, O.—The movement toward getting an electric light plant for Sandusky, O., is now assuming tangible form. An electric light and power company has been formed and the following were elected: President, M. H. Brinkerhoff; vice-president, Dr. R. N. McCannel; secretary, W. Clark; treasurer, Charles F. Plumb; directors, J. J. Stoll, C. Daniels, W. T. Tschauen, J. M. Stevenson, C. D. Juvinall.

Local and Suburban Happenings.—The Automatic Telegraph Improvement Company, of Chicago, has been incorporated. The incorporators are Z. P. Hotchkiss, C. J. Ward and J. M. Sherman. The capital amounts to $100,000 and the company will manufacture apparatus. The town of Rochelle will soon be lighted by electricity and the city of Galena, Ill., was lighted by electricity last week. The plant consists of 100 large incandescent lamps.

Telephone Quotations.—Col. S. G. Lynch, broker, 146 LaSalle street, furnishes quotations upon telephone stock as follows:

Bell of Mo.	$150@$153	Iowa Union	22@ 25
Central Union	50@ 51	Michigan	81@ 82
Chicago	300@ 305	Missouri and Kansas	69@ 70
Colorado	39@ 40	Rocky Mountain Bell	40@ 41
Cumberland	67@ 69	Wisconsin	116@ 117
Great Southern	31@ 33		

The End of the Treacey-Carbon Lamp Company.—A bill to wind up the affairs of the Treacey-Carbon Lamp Company, has been filed by the stockholders, who put $10,000 into the company upon the representation of one James A. Treacey, who claimed that he could make light out of limestone at 1 cent a night that would be superior to electric light. Treacey was to have his plan in successful operation by May last, but he hasn't got it in working order yet.

A Plant for Honduras.—An electric lighting plant for Honduras is now in process of construction at the works of the Van Depoele Electric Manufacturing Company. It is to cost $17,000, and all the parts are of special construction. By the terms of the contract, no one piece of machinery is to exceed 150 pounds in weight. This is because, after reaching a certain point on the way to the mines in the mountain, where the plant is to be installed, the journey has to be completed with mules.

An Old Operator Dead.—Mr. A. E. Trabue, one of the first to read telegraphic messages by sound instead of by the register, died recently at his home at Kirkwood, Mo., after a four days' illness. He was an operator in 1850. When he was at Nashville Tenn., he got out a book of satirical cartoons called "Short Surkits." This book contained pictures of many old operators, his contemporaries, many of whom are still living. It held up to ridicule the efforts made to check the operators from reading by sound and discarding the register. He was 63 years old when he died.

The Standard Electrical Works, Cincinnati, representatives of the Okonite Company, New York, report the demand for Okonite specialties in that section of the country steadily on the increase. They have just closed, against strong competition, a large contract with the Cincinnati Railway Company, to furnish them with Candee Okonite wire for their main lines. The new Chamber of Commerce Building, Cincinnati, has also, through the efforts of this pushing concern, been entirely installed with Okonite wire. The Standard Electrical Works are well known in electrical circles, and have acquired a reputation for handling only the best goods in all their various lines of trade.

A Very Large Isolated Western Electric Plant.—During the past week Liggard & Myers, tobacco manufacturers, have contracted with the Western Electric Company, for a plant to be put into their warehouse at St. Louis, of 200 arc lights and 150 incandescents. The contract includes the steam plant and all the fixtures. This is the second largest isolated lighting plant of the kind in the country, the first, it is claimed, being that of Marshall Field of Chicago, which comprises 250 arc lights. The Western Electric Company have also been awarded the contract to furnish the plant for the city of Galveston, Tex. This plant will be for 175 arc light and 250 incandescents for the public buildings. There is to be 25 miles of wiring.

Unseasonably Good Business.—Although this season of the year is seldom one of great activity among the electric light people an unusually good business has been ruling. The Van Depoele Electric Manufacturing Company has taken the contract to put into the town of Clinton, Wis., a plant of 150 incandescent and six arc lights. The Thomson-Houston Electric Company has taken during the past week the contract to put a 50 light incandescent plant at Forester, Ill.; also one from Austin Electric Light and Power Company, of Austin, Minn., for a 600 light alternating dynamo to increase its present plant. The Chicago Arc Light and Power Company have ordered of the same company an increase of 50 arc lights to their plant. In Hastings, Neb., there is to be installed a plant of 25 arc lights, and the Ottawa Electric Light and Power Company, of Ottawa, Ill., is putting in an alternating plant of 600 lights; both of the Thomson-Houston system. The Pine Bluffs, Ark., Water and Light Company is putting in a plant of 600 lights, of the alternating system.

W. A. N.

PACIFIC SLOPE NOTES.

PASADENA, Cal., March 6, 1889.

The Pasadena Electric Light and Power Company were organized about one year ago, and have now in daily use one 50-light 1,200 c. p., and one 35-light 2,000 c. p. arc machine of the Thomson-Houston system, run by a 65 h. p. Sioux City Corliss engine, supplied by an Atlas boiler of 80 h. p. At a meeting held some time ago it was decided to erect a new and commodious station with every accessory for furnishing subscribers with a perfect, and, so far as possible, uninterrupted service, and to add an incandescent system to the plant. The new building will be of brick, with corrugated iron roof, 40 × 74 feet, one-story, with a lofty broken hip roof, provided with large side and end ventilators.

The boilers will be placed, three of 80 h. p. each, in battery in one end of the building, and will be separated from the engine and dynamo-room by an 8-inch brick wall. The engines will consist of one 150 h. p. and one 75 h. p. latest improved Sioux City Corliss, and will be placed side by side with fly-wheels next the boiler-room. The countershaft will be pillowed on heavy brick piers, and all the pulleys will have friction clutches, so that the engines and dynamos are independent of each other. The dynamos are to be one 50-light 1,200 c. p. arc, one 35-light 2,000 c. p. arc, two 600-light alternating separately excited—all of the Thomson-Houston system.

All the dynamos and other machinery will rest on heavy, independent brick foundations.

Crude oil will be used for fuel, as, besides its cleanliness, it is 30 per cent. cheaper than coal, dispenses with a stoker, and insures a steady steam pressure at all times. The pole line is projected to embrace five miles of streets in addition to the two miles already up, and the extension will be made with iron poles and iron cross arms, whose graceful symmetry will neither obstruct the view nor prove an eye-sore on the beautiful residence avenue. The executive officers for the present year, from March 4, are S. H. Taylor, president; J. M. Glass, vice-president; L. C. Torrance, general manager, and G. T. C. Hall superintendent.

No trouble will be spared to make the plant second to none on the coast, and, as most of the apparatus has already been shipped, the new plant will probably be in operation within sixty days.

Crude oil has been used for fuel since the present plant was put in operation, with one burner under the boiler, and the consumption has averaged 266 gallons per night. They added another burner, lowered both six inches further, leaving the nozzle 26 inches below the shell of the boiler, and the consumption at once dropped to 190 gallons, with the same lights on as before.

SOUTHERN NOTES.

DALLAS, Tex., March 4, 1889.

Mr. Henry Garrett, formerly the city electrician, has assumed his duties as superintendent of the Queen City Electric Light Company.

Mr. J. M. Oram, the well-known electrician, was appointed city electrician at a recent meeting of the Common Council, and assumes his duties March 1.

Messrs. Clower & Harris report business as exceedingly active. Orders for Baxter motors still continue to come in, and are being filled as rapidly as possible. The Queen City power circuit is being filled, and Dallas will soon be one of the principal cities of the country in the matter of power, as well as of light. Bergmann & Co.'s magnificent combination fixtures will soon grace the new City Hall, Clower & Harris, the local agents, having received the contract for the complete installation. Competition was unusually sharp, but these goods carried off the palm. In addition to this splendid evidence of their capabilities they are furnishing some of Dallas's finest residences with combination fixtures. The demand for supplies is steadily on the increase and very gratifying.

The Dallas Electrical Society are now on a firm footing and are getting down to solid work. New members are coming in and the treasury is in a flourishing condition. They are meeting with great success in the establishing of their library, and acknowledge, with pleasure, the receipt of a number of text-books from the publishers of THE ELECTRICAL WORLD and others. They have adopted a novel means of making their rooms attractive, among others, a cabinet or collection of catalogues, samples, models, etc., and have received a number from various manufacturers and dealers. Several meetings have been held and a number of valuable experiments were illustrated. Meetings are held semi-monthly, the next occurring on March 13, when the following programme will be presented: A series of lectures on "The Relative Merits of High and Low Speed Engines," Mr. Wm. F. Lape; 2, "First Principles of Dynamo-Electric Machines," Mr. H. M. Sutton; 3, "The Gravity

Battery, its Mechanical and Chemical Construction," Mr. R. K. Saunders and Prof. C. McCormick.

HOPE MILLS, N. C., March 11, 1889.

Mill Lighting.—The United States Electric Lighting Company are installing incandescent plants in the mills of the Mills Manufacturing Company, at Hope Mills, near Fayetteville, N. C. The plant in mill No. 1 is just completed, having a 400-light United States dynamo, which will supply current for about that number of 110 volt lamps in the spinning, weaving and card rooms and dye-house. The plant in mill No. 2 is nearing completion with a similar dynamo, and about the same number of lamps of the same voltage. These mills are manufacturing checks, ginghams and heavy cottonades. They weave no white goods. Formerly mill No. 1 was lighted by a gasoline gas machine, but they failed to get a satisfactory light with it to see to handle this class of goods. Being all dark colors they require stronger light than they were able to produce, except by electricity. The plants in both mills are run by independent water-wheels that are doing no other work except to run a fire-pump. By this means they secure a very steady power, and can maintain the current at an even potential, which will insure them a steady light, and long lamp life.

The dynamo at mill No. 1 is 600 feet from the mill, and the current is conveyed by eight No. 1 wires. S. B.

ENGLISH NOTES.

(From our own Correspondent.)

LONDON, Feb. 13, 1889.

The Continental Cable Rates.—On and after April 1 next, when the submarine cables between this country and the continent will come under government control, a general reduction of tariffs will take place. Messages to Germany, for instance, will be charged for at the rate of 1½d. a word, in lieu of 2d., with an initial charge of 4d. Similar arrangements have been concluded with Holland and Belgium, and negotiations with France are actively proceeding.

Sir William Thomson on Electrostatic Measurement.—On Friday evening, Feb. 8, Sir William Thomson delivered an address at the Royal Institution on the Measurement of Electrostatic Potential. After dealing with the more refined and theoretic methods, he came to such apparatus as is used in the practical applications of the electric current. He described his own beautiful current balances, in which a simply marvelous degree of accuracy and perfection has now been attained. He then spoke of the Cardew voltmeter, which he described as a kinetic method of measuring potential differences. Finally he exhibited (for the first time) an instrument of his own, which, by a purely static effect—that is to say, without being traversed by any current, however small, gives a scale reading of from 40 to 120 volts. This instrument is based upon the principle of the electrostatic attraction or repulsion of the charged surface of a double set of vanes or blades, which are respectively connected with either terminal. Like all Sir William's instruments, the details are worked out with elaborate care and ingenuity, and there can be not the least doubt that the electrostatic voltmeter will speedily take its place among the most useful of our practical every-day apparatus. It may be remembered that Sir William has previously shown an instrument of a different type, but based upon the same principle, which was capable of measuring from a few hundred up to 10,000 volts; but the difficulty is obviously much greater with lower potentials, particularly when, as in this instance, the scale is made proportional throughout.

The Progress of Electricity.—A long letter, occupying considerably over a column of small type, was recently addressed to the *Times*, by Major Flood-Page, the secretary of the Edison-Swan United Electric Light Company. The letter was written in order "to bring together a few facts connected with the increase of electric lighting in England," and goes on to say that, "doubtless, it will be a matter of astonishment to many to be informed that there are actually in operation nine central stations, some small, but others of considerable importance, in London, while twelve others are in progress." Major Flood-Page is apparently quite satisfied with these figures, and predicts brilliant things for the future. Even the somewhat discouraging past history of electric lighting affords consolation to the sanguine major, insomuch as the early days of gas enterprise yielded even poorer results. Between 1810, the year in which the first gas act was passed, and 1820, only 20 gas companies received powers. Moreover, during the first 40 years only 134 companies, with an aggregate capital of £6,602,000 were formed. On the other hand, the public electric lighting companies in this country alone have at present a capital of over £4,000,000, and yet it is scarcely seven years since the passing of the first electric lighting act. Major Flood-Page thinks "there is no reasonable doubt that electricity will be used for motive power as much as or more than for lighting," and in short the whole letter is of a very optimistic character. It is, of course, to be hoped that letters of this kind may imbue the general public with some of the enthusiasm which, as a rule, distinguishes their writers. But with gas at at 2s 3d. per thousand and so many similar predictions as yet unfilled, I am afraid the British public will await the advent of the "new illuminant" with great equanimity. An outward and visible sign of the progress of electricity, in the shape of general street and house-to-house lighting, would probably prove more efficacious than even a weekly prophecy in the *Times*.

The Whitehall Central Station.—I have recently had the opportunity of inspecting the Whitehall Station of the Metropolitan Electric Supply Company. This station has a 10,000 light capacity, and has been in operation since October. A more desirable centre for distribution could scarcely be imagined, for within a radius of about one-third of a mile all the large clubs and most of the large hotels, restaurants and theatres of the metropolis are to be found. The station is situated underground in rear of the fine block of buildings, now rapidly approaching completion, known as Whitehall Court. This building, which is several stories high and facing the river, is intended to be divided into flats, and as gas is not laid on, the demand for current for Whitehall Court alone will in time tax the resources of the present station, which already supplies current to the Grand Hotel, the Hotel Metropole, the Hotel Victoria, the Avenue Theatre, St. Martin's Church and several other large buildings The whole of the plant, including boilers, engines, dynamos, batteries, pumps and condensers, has been fitted into a space of 87 by 40 feet. However much we may admire the ingenuity displayed in effecting this it is to be regretted that such an important station should be obliged to experience the disadvantages attendant on overcrowding. The plant comprises three 170 h. p. triple expansion vertical engines made by Willans & Robinson, coupled direct to Siemens shunt-wound dynamos, having each an output of 100 kilo-watts. These machines are used to charge the Elwell Parker secondary batteries, of which there are nearly 1,000 in position. The mains are laid underground in Callender-Webber conduits. Whenever a subway is available, however, the cables are placed in strong wooden boxes and buried in the base of the subway. At present all the lamps supplied from the station are charged for at so much per lamp per annum, the meter system not being deemed sufficiently reliable. Several meters are, however, being experimented with, and, no doubt, before long a more satisfactory method of charging will be adopted. In addition to the supply of current the Whitehall station has contracted to warm Whitehall Court by means of the exhaust steam, besides having undertaken the hydraulic arrangements for working the eighteen lifts used in the building. The whole of the arrangements have been carried out under the direction of Mr. J. E. H. Gordon, and the station seems likely to prove one of the most paying in the metropolis.

The Settlement of Electrical Trade Disputes by Arbitration.—At the conclusion of the hearing of the appeal in the Gaulard-Gibbs v. Ferranti action, two of the judges took occasion to comment upon the extreme and unnecessary length at which the arguments of the learned counsel had been set forth. The case had occupied altogether ten days, and it must be remembered that this time was consumed solely in the arguments of counsel, since being an appeal case, no witnesses were heard. Mr. Aston, Q. C., counsel for Gaulard-Gibbs, occupied three days in his opening speech and two days in his closing speech. The judges very properly remarked that the whole case might have been got through in four days. There is no doubt whatever that this state of things constitutes a crying evil. It is, therefore, with some considerable satisfaction that the electrical world here has learned that a possibility now exists, or will shortly exist, of a settlement of matters in dispute betwixt the trade by a competent tribunal without recourse to the slow and expensive methods of the law. The electrical section of the London Chamber of Commerce has decided to take advantage of that clause in the charter of the Chamber which provides for the conduct of arbitration cases. The method of procedure will be somewhat as follows: A statement, either made severally or conjointly by the parties to the dispute, will first be laid before the Arbitration Committee of the General Council, which will decide whether the case is such a one as to admit of their taking it up. In the event of this being settled in the affimative, on payment of 15 guineas for members of the Chamber and 20 guineas for outsiders, the case will be remitted to the committee of the electrical section, and the parties will then have the privilege of selecting for themselves ony one or more of the members of the committee, who may be willing to act as arbitrators. The remuneration provided is not to exceed 10 guineas per diem. The parties will then be required to enter into a formal agreement, which will have a binding force in law, to abide by the decision of the arbitrators, subject only to an appeal to the General Council of the Chamber, which may be resorted to on payment of a further fee of 15 guineas in the case of members, and 21 guineas when the appellants are not members of the Chamber. At a recent meeting of the committee considerable discussion ensued as to whether or not the parties were to be permitted to be represented by counsel. It was found that this was contrary to the provisions of the Chamber itself, but the feeling being in favor of such permission, the General Council of the Chamber was to be asked to sanction it. It remains to be seen whether this tribunal will command the confidence of the trade, but in any case the idea is excellent.

LONDON, Feb. 20, 1889.

The Continental Cables.—As I mentioned in my last letter, the English Government has come to a mutually satisfactory agreement with the governments of Germany, Belgium and Holland, with regard to the acquisition and future working at reduced rates of the submarine cables connecting the United Kingdom with these countries. The French Government, however, has adopted a very characteristic attitude in this respect. Its engineers have suddenly discovered that the Submarine Cable Company's cables connecting France and England are quite worn out and worthless. The French Government therefore, declines to entertain the proposed purchase scheme, and demands that new cables shall be laid down, the old cables being abandoned as old iron at the bottom of the channel. It is to be hoped that our Postmaster General will be firm in demanding fair play for the submarine company, whose only fault seems to be that it has managed to pay decent dividends.

The Edison-Swan Case.—The Court of Appeal delivered judgment in the case of "the Edison-Swan Company vs. Holland and others" on Monday morning. Three individual but unanimous decisions were delivered by the court. Each of them was short and to the point, and did not go nearly as much into detail as did Mr. Justice Kay in the court below. The patent was upheld at all points. Lord Justice Cotton said that as regards the construction of the specification, he considered himself bound by the previous decision of the case in the action of 1886 against Woodhouse & Rawson. In that case the court held that if there was no anticipation of the invention it was a good subject matter for a patent, being a combination of parts, which, although not new, were rendered useful by the method of putting them together. So far he was bound by the decision of the previous court. The court had also decided that the utility of the invention was established, but it was now sought to show that the fresh evidence which had been discovered traversed that opinion. The present argument was that no lamps had ever been commercially disposed of, which were constructed precisely in accordance with the specification. He should, however, hold that a patent was not to be invalidated simply because subsequent inventions improved the patented article, or because in consequence of subsequent improvements no article was in fact made in accordance with the specification. He then dealt with the objection on the score of want of novelty, pointing out that this was a question of fact. The only alleged anticipation which his Lordship thought worthy of consideration was that of Swan's lamp, marked F. J. B. 1, which was exhibited in December, 1878, by Mr. Swan. He thought, however, from the evidence of Mr. Swan himself, and also of Mr. Stearn, that they had never regarded this lamp as a success; in fact, it was an experiment which had been tried, which had failed, and which had been abandoned. The difference introduced by Edison, which had changed failure into success, was chiefly in the thickness of the carbon burner. He could not, therefore, hold that this was an anticipation. With regard to the lampblack and tar question, he could not attach much importance to the failure of the defendants to make such a lamp, especially when lamps had actually been put into court of this construction. Therefore the whole of this branch of the case fell to the ground. Lord Justice Lindley dealt chiefly with the legal aspect of the case, pointing out that the Patent Act lays upon the patentee the necessity of complying with two separate and distinct conditions. First, that he should particularly describe and ascertain the nature of his invention. Secondly, that he should particularly describe and ascertain in what manner the same is to be performed. The two conditions, although often confused and overlapping, were really distinct, and it is always necessary to keep each clearly before one's mind, and not to commit the mistake of supposing that compliance with one is necessarily compliance with the other. His Lordship then examined in detail the question as to how far Edison had complied with these two conditions in the case under consideration, coming to the conclusion that no valid objection could be sustained upon this ground. Lord Justice Bowen dealt with the vexed question of the interpretation of the term filament. He saw no reason to hold that it was too vague. He thought that in the year 1879 any one would have taken it to imply the idea of a slender thread or thread-like substance, and he did not think it necessary that Edison should have defined the term. It was a descriptive term, not a definition. He concurred in the judgment already pronounced, that the appeal should be allowed with the ordinary results as to costs. The Attorney-General, on behalf of the Edison-Swan Company, then applied that the costs should be given against the Anglo-American Brush Corporation as parties to the action, and that an injunction should also be issued against them together with an inquiry as to damages. The judges, however, refused to do this. It appears that in point of law there is a great distinction between a defendant and a "party to an action," and after a prolonged discussion between the bench and the bar, it was ultimately decided that although the Brush Company should be condemned in costs (to which they raised no objection), yet that no injunction and no inquiry as to damages should issue. The result appears to be that a fresh action will have to be brought against the Brush Company, in order to prove that the lamps made by them infringe the Edison patent. I understand that the case will be carried to the House of Lords.

LONDON, Feb. 27.

The Edison-Swan Case.—A story, connected with the Edison-Swan case, has been going the round of electrical circles, which possesses the advantages of truth and of drollery. Some time ago, in anticipation of legal proceedings on the part of the Edison-Swan Company, the Anglo-American Brush corporation adroitly secured the services of three of the most eminent counsel at the bar. The Edison-Swan people, not to be outdone in smartness, proceeded, however, against Holland, a user of Brush lamps, and not directly against the infringing company. The aforesaid eminent counsel innocently accepted retainers on behalf of Edison-Swan in the action against Holland, so that when the Brush Company succeeded in being made "third parties in the action," Sir Richard Webster, Q. C., Mr. Aston, Q. C., and Mr. Moulton, Q. C., were placed in a somewhat awkward position. An understanding was eventually come to, however, and the Edison-Swan Company retained the services of these three eminent Q. C.'s in the action of Edison-Swan vs. Holland and others. But now we come to the joke. Owing to the refusal of the Appeal Court to issue an injunction against the Anglo-American Brush Corporation, it is more than probable that the Edison-Swan Company will be obliged to attack their opponents directly. The three eminent counsel will then appear on the other side, and we shall witness the diverting spectacle of these doughty defenders of the Edison patent, assailing it with all the vigor of recent converts.

King, Brown & Co. vs. the Anglo-American Brush Corporation.—The compound-winding case has been resumed in the Court of Session at Edinburgh, some interesting evidence of Charles Francis Brush, of Cleveland, Ohio, taken by commission, being read on behalf of the Brush Company. On being asked to state generally the amount of knowledge in England and America in the year 1878 as to the winding of dynamo magnets, Mr. Brush replied that the knowledge then possessed was exceedingly crude, the machines of that date being quite unable to grapple with varying loads. The object of his invention, he said, was the production of a dynamo that would automatically maintain a sufficiently constant potential under varying amounts of work in the external circuit. It was true, he had described his machine as suitable for electro-plating, but that was not the only use for it that he had in mind, for in his specification he said very plainly "other useful applications of a permanent field machine will readily suggest themselves." He first began to make machines according to his specification in the latter part of 1876 or early in 1877. As a proof of the great advances recently made in the construction of constant potential machines, it is interesting to note the results of some tests of dynamos, which were made by Mr. Brush and sent by him on Aug. 4, 1882, to Mr. Swinburne. No. 7 machine running at 800 revolutions, gave 13.9 ampères and 87.57 volts; when the current rose to 44.3 ampères, the E. M. F. rose to 90 volts, and then fell again, until at 100 ampères the E. M. F. was but a fraction over 67 volts. In the case of No. 5 machine, running at 865 revolutions, with 2.7 ampères the E. M. F. was 147.55 volts, with 10.8 ampères the E. M. F. rose to 150.1 volts, and with 22.8 ampères the volts had fallen to 110.34. The case is still proceeding.

BUSINESS NOTICES.

Battery Cut-Out.—Attention is called to a simple device for disconnecting gas lighting batteries if accidentally grounded. It is cheap, sensitive, never needs watching, and has no clockwork to be kept wound. Terms furnished by the Electric Supply Company, No. 3 South Warren street, Syracuse, N. Y.

Special Tools for Dynamo Builders.—Realizing that to put upon the market improved electrical machinery, specially designed lathes and tools were necessary, Lodge, Davis & Co., machine builders of Cincinnati, O., have decided to cater especially to that class of trade. They have opened a branch office at Chicago.

Patterson, Jordan & Gottfried, 146-150 Centre street, carry a complete stock of brass and iron machine and wood screws, cap and set screws, all kinds of bolts, taps, files, twist drills, brass and rubber tubing, brush copper, rod and sheet copper, brass rod, sheet German silver, sheet brass, machinery, tools, hardware, etc. Electric motor supplies.

Wheeler Reflectors.—Nearly every one of the older electric light companies who operate incandescent lights are familiar with the peculiar merits of the mirror plated shades manufactured by the Wheeler Reflector Company, Boston, Mass. This company is at present very busy in filling orders for electric light companies parent and local, in nearly every section of the country.

Reliance Safety Water Columns.—Among the electric light people who have recently adopted the Reliance safety water columns made by the Reliance Gauge Company, of Cleveland, O., are E. H. Johnson, Greenwich, Conn.; the Millford Electric Light and Power Company, of Millford, Mass., and the California Electric Light Company, of San Francisco. The latter company after thorough investigation took ten columns.

The Page Belting Company, of Concord, N. H., are steadily increasing their business both in volume and in kind. They report that during the months of January and February their business has been very much larger than for the corresponding months of last year. Various changes have been made in their facilities for selling. Their Chicago branch is now very important under an improved organization, and their new store, opened at 17 Federal street, Boston, where very large stocks of both leather and rubber goods are carried, adds largely to their facilities. They have just started in the manufacture of metallic tipped laces.

OUR ILLUSTRATED RECORD OF ELECTRICAL PATENTS.

PATENTS DATED MARCH 12, 1889.

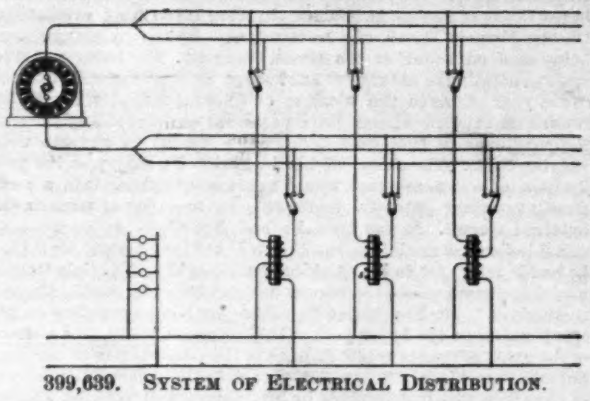
399,236. Electric Railway; J. B. Blair, Chicago, Ill., Assignor to himself and U. Blickensderfer, of same place. Application filed Nov. 19, 1887. Claim 1 is as follows: In an electric railway, the combination with the car of a motor carried by it for propelling its wheels, an electrical connnection between said motor and conductors along the car, contact bolts or cores adapted to be projected above the road bed or track, the main conductor connections between said conductors and the contact bolts, and means for projecting said bolts or cores above the bed or track to complete the circuit through the motor.

399,269. Switch-Board; John W. Kelly, Minneapolis, Minn. Application filed March 13, 1888. The invention is designed more especially for use in electric light stations, and it has for its object to provide a switch board which will afford a convenient means for connecting several dynamos to the same lamp circuit, or of cutting out one dynamo and throwing in another without stopping the lights, or of connecting together several lamp circuits through one dynamo, or the several dynamos and the several lamp circuits.

399,274. Secondary Battery Electrode; A. V. Meserole, New York, N. Y. Application filed Dec. 26, 1888. It is desirable to have the electrodes so constructed that the electric current in passing through, into, or out of the electrode, will be so distributed and conducted as to act upon every part of the contained material. This is accomplished in a novel manner by the present invention, by having a large surface of contact between the absorbent or depolarizer and the conducting body of the electrode, and by admitting of free access and circulation of the electrolyte above the deposited material contained within the electrode.

(1) 399,291. (2) 399,292. (1) Hydraulic Press for Covering Electrical Conductors with Soft Metal; (2) Electrical Measuring and Controlling Apparatus; (1) Werner Siemens, (2) Wilhelm Siemens, Berlin, Germany, Assignors to Siemens & Halske, of same place. Applications filed Aug. 30, 1884, and Dec. 2, 1887, respectively. 1. In a hydraulic press for covering electrical conductors with soft metal, the combination of a plunger, rotated in a plane perpendicular to the direction of the mandrel, with a mandrel capable of being raised and lowered. 2. The invention relates to apparatus made use of for the observation and measurement of physical magnitudes of every description—for instance, the measuring of the potential difference between any two points of an electrical circuit, or the height of wat er level. The object is attained in case of measurement of length by the conversion of that measurement into one of the potential difference of two points in an electrical circuit. Claim 1. In an electric meter, the combination of two electrical circuits, an electromotor, the field and armature coils thereof forming a part of one of the said circuits, means actuated by the other or second circuit for controlling the said motor, and resistances adapted to be included in or excluded from the second, thereby changing the amount of current passing through the second circuit, while the current in the first circuit remains unchanged by the insertion or exclusion of the said resistances, as and for the purposes described. See illustration.

399,305. Lightning Arrester; C. H. Wilson, Columbus, Ohio, assignor to the Western Electric Company, of Chicago, Ill. Application filed Nov. 19, 1887. The invention consists of two springs placed over metal plates, the two springs being connected



399,639. SYSTEM OF ELECTRICAL DISTRIBUTION.

by a fusible wire supported upon a bead upon a frame or base in such a manner that the springs are normally suspended above the underlying metal plates.

399,314. Telegraph System; Wm. Burnley, North East, Assignor of two-thirds to Samuel A. Davenport, of Erie, and Chas. A. Hitchcock, of North East, Pa. Application filed July 9, 1888. There are employed ordinary relays and receiving instruments and a novel telegraphic transmitting instrument, which maintains a constant and unbroken current of electricity over the main line and operates to raise and lower the potential of the current over the line, so as to cause the relays and sounders to operate in unison with the operation of the transmitting instrument, and with the rise and fall of the potential of the current controlled thereby. See illustration.

399,320. Dynamo Machine G. L. Du Laney, New York, N. Y. Application filed Aug. 22, 1888. The invention relates to the construction of the pole pieces for field magnets and the manner of uniting the same; to the provision and construction of vulcanite or non-conducting disk for mounting the armatures; to the construction and application to the disk of sections or segments composing the ring or core of an armature; to the method of connecting the ends of the windings to the commutator bars, and to the peculiar plan and general construction of the machine.

399,326. Coupling for Electric Circuits; A. C. Griggs, Wilmington, Delaware. Application filed Jan. 2, 1889. The objects which the coupling are devised to attain are, first, to enable the coupling of the wires of two cars to be easily, promptly and securely made, and, second, to temporarily close the circuit in the act of coupling or uncoupling, so as to actuate the signal as each car is joined or parted from another, thus insuring the proper union of the wires in the train and their working condition, and giving notice if they get out of order.

399,328. Dynamo Armature; J. A. Hayes, San Francisco, Cal. Application filed May 2, 1888. The armature involved in this invention is constructed in sections and the sections are built up of insulated laminated iron plates.

399,329. Commutator for Dynamo-Electric Machines and Motors; B. Heywood, New York, N. Y. Application filed May 11, 1888. The improvement consists in the combination of the commutator and a rotary brush having the planes of the bars of the commutator and the plane of the axis of the brush oblique to each other at the line of their contact.

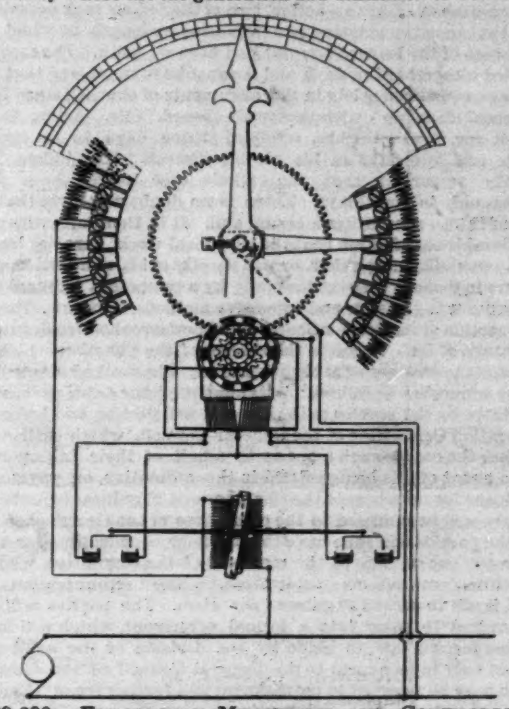
399,331. Electric Railway Switch and Alarm; W. S. Hull, Sheffield, Alabama, and J. C. Anderson, of Charleston, N. C. Application filed May 21, 1888. The objects in view are to provide an electrical and mechanical construction which will not only serve the purpose of indicating any displacement of the switches, but which shall also be adapted for conveying messages back and forth between the office or other place and the switch stand.

399,336. Electric Meter; E. F. H. H. Lauckert, Charlton, Assignor to Siemens Bros. & Co., Ltd., Westminster, England. Application filed Oct. 5, 1888. The counter or index is connected with clockwork by a magnetic clutch consisting of a pair of iron bosses facing each other, one of them on an axle driven by the clockwork, the other on an axle belonging to the counter or index, either or both of these bosses being surrounded by a coil or wire forming part of the circuit of the lamp or other consumer of electricity, or being in a shunt from that circuit.

399,341. Electrical Appliance for Stopping and Starting Elevators; R. F. McFeely and H. V. Potter, Pittsburgh, Pa. Application filed Dec. 12, 1887. Claim 1 is as follows: In an electric elevator the combination of the continuous contact strips connected in circuit with valve-controlling magnets, the space broken contact strips, a switch-board carried by the elevator car and having brushes normally bearing against said continuous strips, a series of brushes adapted to contact with the spaced broken strips, and a switch movably mounted on the switch-board.

399,343. Underground Electric Wire Conduit; W. L. Penny & T. Little, Pittsburgh, Pa. Application filed Jan. 16, 1888. The combination, with an underground conduit for electric wires, of a plate of sufficient size to fit wholly within said conduit, said plate being provided on its face at opposite sides of its center with a right angle groove, one branch of each groove being in line with the interior of the conduit and the other branch of each groove extending at right angles thereto to the longitudinal edge of the plate, whereby a conductor extending through the conduit may pass through a right angle groove at each side of the center of the plate, and thus expose a portion of said conductor beyond the edge of said grooved plate.

399,372. Electric Railway System; Charles S. Bradley, Yonkers, N. Y. Application filed Aug. 8, 1888. Arrangements by whose use the generation and utilization of current are



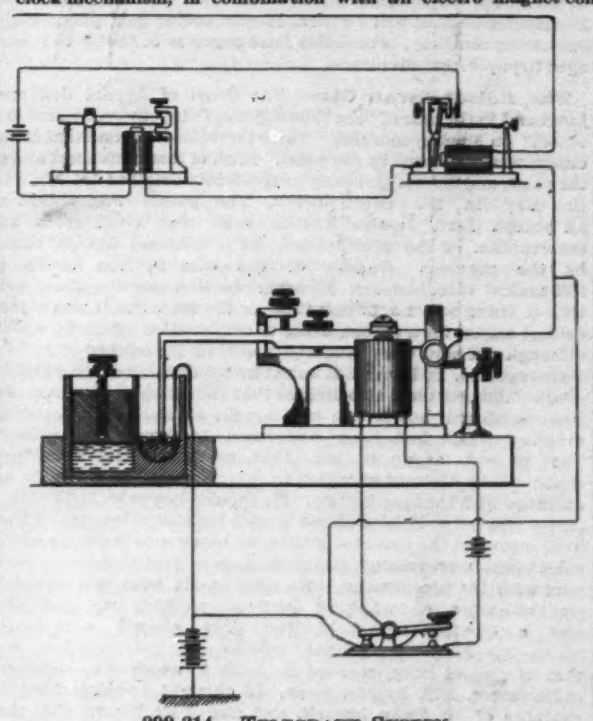
399,292. ELECTRICAL MEASURING AND CONTROLLING APPARATUS.

effected on the spot, and thus stationary generators, main conductors and storage batteries are dispensed with, and perfect regulation with maximum efficiency under variable loads and speeds is rendered attainable. Claim 1 is as follows: The combination with a prime mover provided with means for automatically regulating its consumption of energy proportionally to the load and dependent thereon, and a dynamo electric generator driven thereby and provided with means for varying its potential, both located on a moving vehicle, and an electric motor energized by said generator, and constituting the propelling device for said vehicle.

399,375. Magnetic Separator; J. A. Burden, Troy, N. Y. Application filed Jan. 18, 1889. The invention consists of a roller made of iron that is divided in two parts in a plane at right angles to its axles, and having insulated bearings being adapted to be rotated within a magnetic field, said roller being provided with means to remove from the magnetic roller the attracted magnetite.

399,377. Electric Circuit; J. J. Carty, New York, N. Y., Assignor to the American Bell Telephone Company, of Boston, Mass. Application filed Jan. 23, 1889. In a telephone system an electrical circuit, consisting of two pairs of main lines, the lines composing each pair being transposed at intervals, and said pairs being transposed at intervals. See illustration.

399,400. Electric Circuit Protector; W. B. Harvey, Memphis, Tenn. Application filed Feb. 28, 1888. A circuit protector for telegraphic and analogous electrical circuits, consisting of a clock mechanism, in combination with an electro magnet con-



399,314. TELEGRAPH SYSTEM.

trolling its operation and a normally open shunt around the key, including in its circuit a switch controlled by said clock mechanism, whereby the key will be automatically shunted and whereby the main line is left open at any point.

(1) 399,401. (2) 399,402. (3) 399,403, and (4) 399,404. (1) and (2) Prevention of Sparking in Dynamo-Electric Machines and Electric Motors; (3) and (4) Dynamo-Electric Machines; Daniel Higham, Philadelphia, Pa., Assignor to the Higham Electric Light Company, of Rockland, Me. Applications filed June 7, 1888. (1) A dynamo electric machine or motor, in which the armature and field magnet currents are constant, or vary simultaneously, and having a magnetic conducting bar, not an electo-magnet, adjacent to a pole piece of the field magnet, and acting on the short circuited armature coils. (2) A dynamo electric machine or motor having a magnetic conducting bar acting upon the short circuited armature coils, a helix upon said bar and coils upon the field magnet connected to the said helix, but not connected with the field magnet coils or working circuit. (3) A frame for a dynamo electric machine or electric motor, having a horizontal field magnet core resting upon and secured to the pole pieces, between which the armature revolves. (4) A commutator having segments with insulating blocks and air spaces, and clamping rings not covering the ends of the air spaces.

399,409. Conductor for Electric Railways; R. M. Hunter, Philadelphia, Pa. Application filed March 16, 1888. An electric railway working conductor consisting of a tube having a longitudinal slot, and also having the thickness of its metal greater as the slot is approached from either side.

399,416. Electric Gas Lighter; E. Kronenberg, Philadelphia, Pa. Application filed Oct. 17, 1888. An igniting device for lighting segars, cigarettes, etc., consisting of a pendant, in combination with a gas cock having an operating lever carrying a movable electrode, and a burner tip carrying a fixed electrode, the lever having a retractile spring for holding said cock closed and the electrodes out of contact.

399,474. Railroad Signaling Device; F. P. Benjamin New York, N. Y. Application filed Feb. 11, 1888. In a system of railroad signaling, the combination of a plurality of local circuits, each circuit including make and break devices, and a make and break device common to a plurality of said circuits, whereby when the circuit is completed in one of said local circuits it is automatically broken in the other.

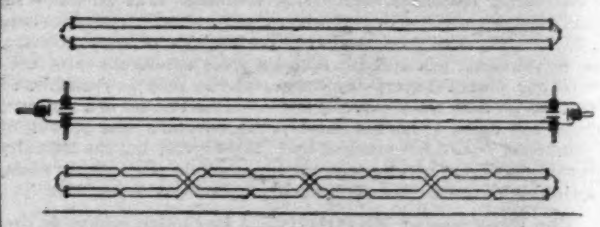
399,497. Combined Gas and Electric Light Fixture J. C. Cassidy, East Orange, N. J. Application filed Jan. 3, 1889. The object of the invention is to facilitate applying the electric conductors to the gas arm and connecting that part of the arm containing the electric wires with the gas-conducting part.

399,505. Transmitting Instrument for Electric Signaling Apparatus; W. J. Dudley, Everett, Mass., Assignor to the Dudley Electric Manufacturing Co., of Concord, New Hampshire. Application filed July 19, 1888. The transmitting instrument forming the subject of this invention is adapted to automatically transmit a number of actuating currents or impulses, by which the step-by-step devices of all the signal-controlling instruments on the circuit are moved far enough to bring them to the unison position at which they are arrested by the unison-armature, immediately after which the transmitting-instrument causes an alternating magneto current or feeble battery current of opposite polarity to the actuating currents to be sent over the line for a moment, and thus effects the release of all the step-by-step devices by the unisoning-armatures; after which the transmitting instrument sends a definite number of actuating impulses by which all the step-by-step devices are advanced a certain number of steps requisite to place the signaling instrument at the station to be called in operative condition with the said number of steps, placing but one such instrument in circuit at a time after the manner well known to those familiar with individual signaling apparatus.

399,534. System of Electrical Distribution and Conversion; T. H. Hicks, Detroit, Mich., Assignor to the Hicks Induction Light and Motor Company, of Michigan. Application filed April 26, 1888. The invention consists in the peculiar manner of producing pulsating currents by separately collecting all the like electrical impulses of a generator organized for the production of alternate currents of high potential, and distributing the current thus divided into two pulsating currents, over distinct main conductors, and arranging in operative relation to each of said conductors a generator excited by the supply current for feeding the translating devices during the interruption of the supply current, whereby the breaking of the current and consequent loss of energy, as in the ordinary production of pulsating currents, is avoided.

399,535. Secondary Battery; J. L. Huber, Hamburg, Germany. Application filed Jan. 12, 1889. Claim 1 is as follows: In a secondary battery, an electrode having the conductor or conductors of electricity in the form of net work, grating, or screen embedded in the active mass for the storage of electricity, which mass is provided with perforations or impressions corresponding with the meshes or holes of the conductor.

399,550. Electric Switch; Harry T. Paiste, West Chester, Pa. Application filed April 28, 1888. A form of snap-switch, the



399,377. ELECTRIC CIRCUIT.

novelty residing in the details of construction. See THE ELECTRICAL WORLD, Nov. 24, 1888.

399,556. Electric Railway Signal; T. A. B. Putnam, New York, N. Y., Assignor to the Railway Cab Electric Signal Company, of same place. Application filed Oct. 3, 1885. Claim 1 is as follows: In an electric railway signal, the combination of an induction coil with the opposite terminals of the primary connected electrically to a signal transmitting point along the track, and a remote signal receiving point to which the terminals of the second coil are electrically connected.

399,579. Semaphore Signal; F. Stitzel and C. Weinedel, Louisville, Ky., Assignors to the American Semaphore Company, of same place. Claim 1 is as follows: The combination, with a railroad track, of a semaphore signaling apparatus having electro-magnets located at each end of a block of said railroad, a closed circuit through the track and semaphore at one end of the block, and a second closed circuit through the semaphore at the opposite end of the block, said second circuit being adapted to be automatically broken by the operation of the first-mentioned semaphore.

399,591. Coin-Operated Induction Coil; P. G. Williams and A. W. Roovers, Brooklyn, New York, Assignors to the Automatic Battery Co., of the same place. Application filed Sept. 1, 1888. The improvements relate to that class of machines in which a coil of given weight and size is employed to energize an induction coil in such manner that an electric current will be transmitted through electrodes to a person grasping and operating said electrodes.

399,599. Regulator for Electrical Machinery; G. H. Condict, Philadelphia, Pa. Application filed Oct. 1, 1888. The object of the invention is to provide a suitable construction of regulator adapted either to electric motor or other purposes, and with an especial view to electric traction, whereby the electricity passing to the translating device may be varied or suitably regulated as to tension and volume, or both, and during any change in the current supply produced by the regulator the mechanism shall be such that the current shall be completely severed before the regulator is adjusted to a new position.

399,635. Telephone Line Cable; G. F. Shaver, New York, Assignor to the Shaver Corporation, of same place. Application filed July 5, 1888. The combination of a diaphragm of a telephonic instrument with one or more metallic wires connected thereto, which wire or wires are wound around, inclosed, or are impacted upon a fibrous core.

399,639. System of Electrical Distribution; Geo. Westinghouse, Jr., Pittsburg, Pa. Application filed Nov. 23, 1886. The object of the invention is especially to provide means for supplying the required currents in such a manner that should there be any interruption in the connection of any given supply conductor there will be convenient means at hand for substituting therefor or interchanging therewith, another supply conductor, thus providing a path for the currents until the original circuits are repaired. Claim 1, is as follows: The combination with a source of electricity, of multiple conductors extending from the respective poles, a series of converters having their primary coils respectively connected with different pairs of said conductors, and a single pair of distributing conductors with which the secondary coils are connected in multiple arc.

399,707. Switch for Electric Motors; A. H. Eddy, Hartford, Conn. Application filed Sept. 28, 1887. In an electric motor having a switch for changing the machine into a shunt or series machine, the combination of the switch, with a catch for holding it in its position for starting, and a spring for throwing it into its second position upon the releasing of the catch.

The brief of patent No. 397,966, in the issue of March 2, 1889, seems to have given rise to a misconception of the invention. The following brief thereof will perhaps be found to be more clear: Most ammeters as at present constructed require calibration at more or less frequent intervals, in consequence of the falling off in strength of the magnets forming a necessary part of them. This invention has for its object to provide an ammeter which will require no calibration. This is accomplished by means of a magnet which is a magnet only at the moment of measuring the current, being substantially without magnetism when not actually subjected to the current of electricity to be measured.

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